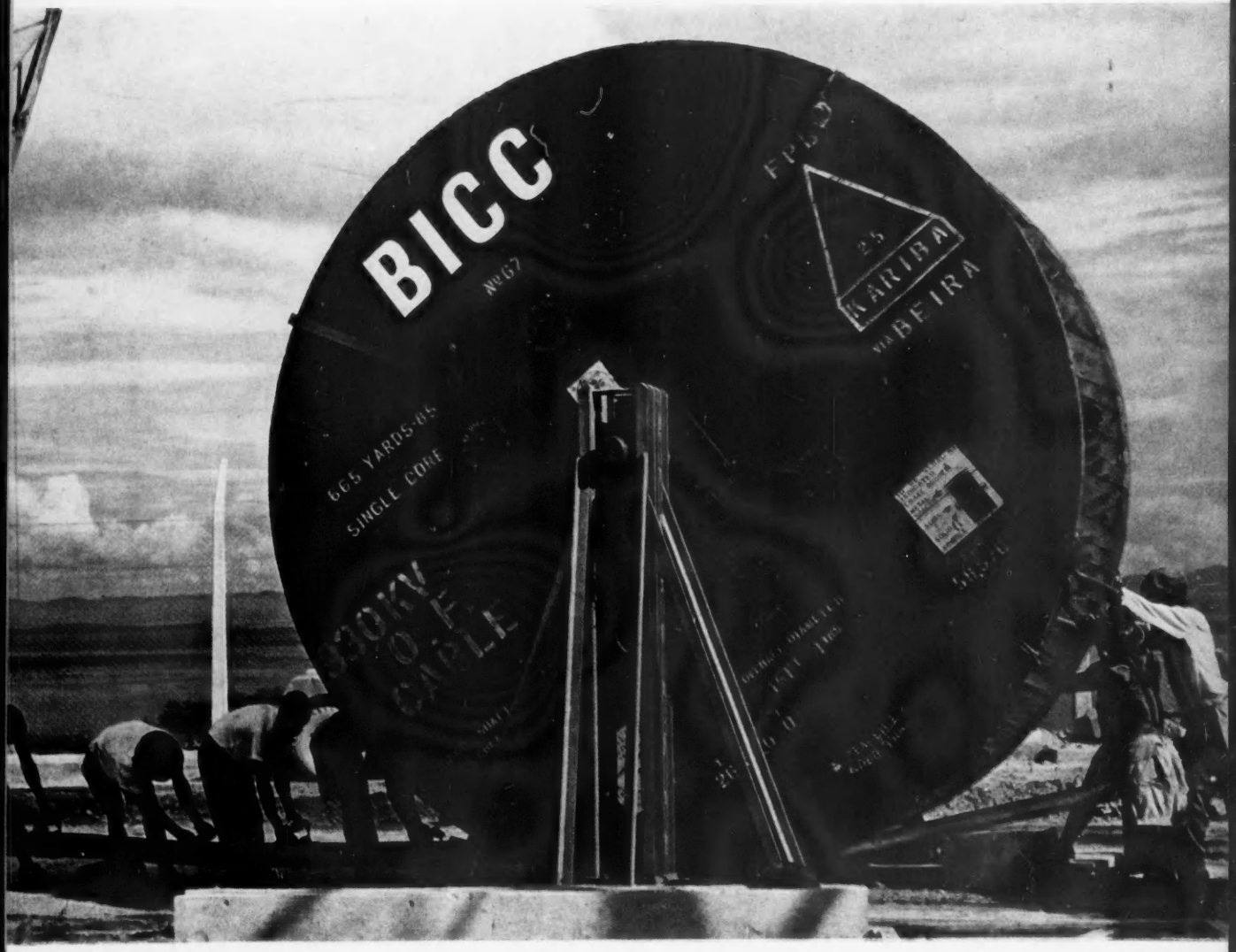
25 AUGUST 1960

ONE SHILLING
AND SIXPENCE

ELECTRICAL TIMES



330,000 volt cables at Kariba

Ascending a 540 foot vertical shaft in the rock, twelve single-core 330,000 volt oil-filled cables link the Kariba power station with the transmission lines above.

To overcome installation difficulties each cable was produced in a continuous unjointed length, the longest being 665 yards. Total length of 330,000 volt cable supplied — 6,718 yards.

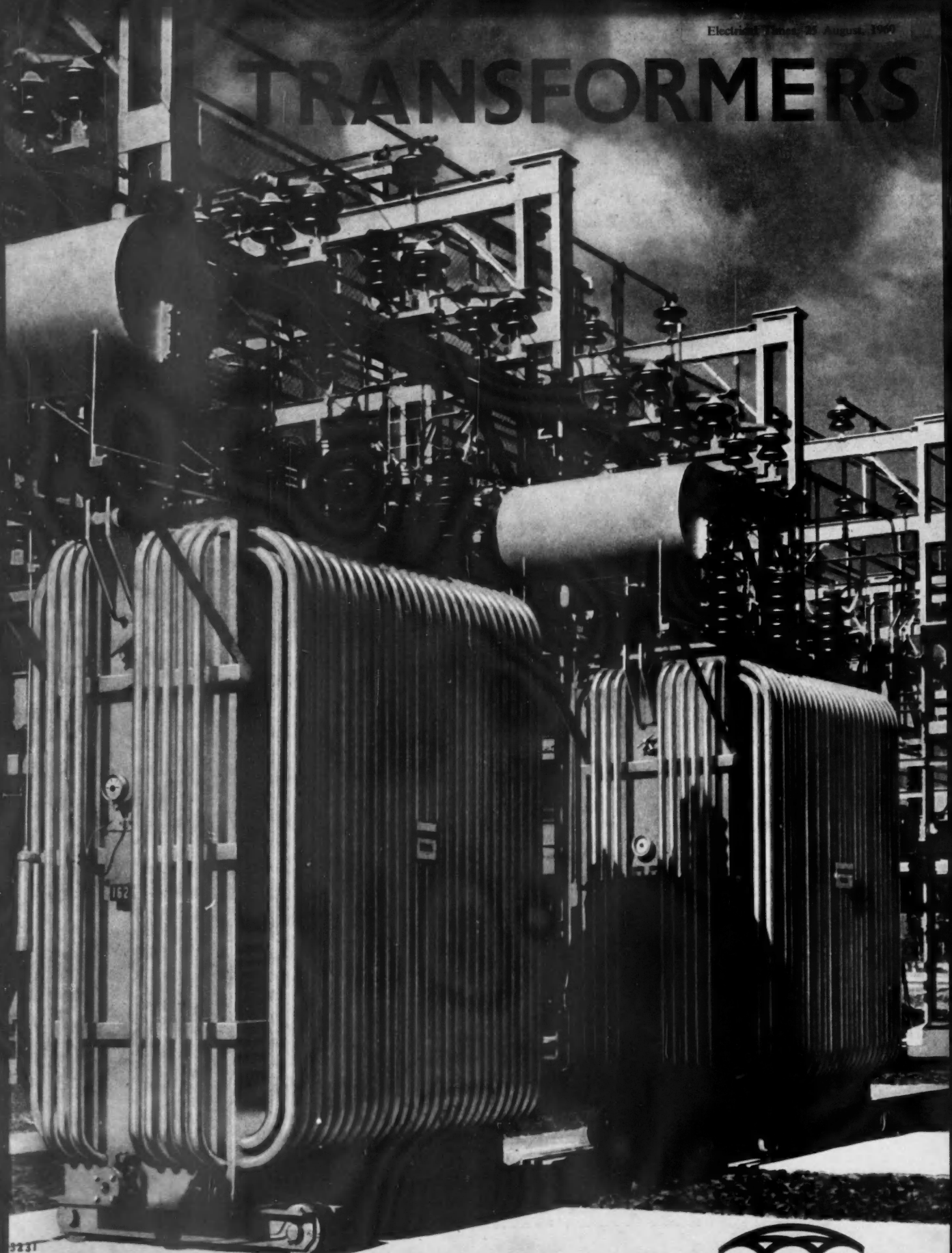
These cables, operating at the highest voltage in Africa, were designed, manufactured and installed by the BICC Group.

The Electrical and Mechanical Consulting Engineers: Messrs. Merz & McLellan.

BICC

BRITISH INSULATED CALLENDER'S CABLES LIMITED 21 Bloomsbury Street London WC1

TRANSFORMERS



BUSHBURY ENGINEERING WORKS
WOLVERHAMPTON

ECC

a rural transformer of unique design

WELDED STEEL CONSTRUCTION

The tank of this latest 'ENGLISH ELECTRIC' 5 kVA transformer is made of two robust steel pressings which are welded together, forming a single, completely sealed unit.

Other features include:

- All bushing gaskets under oil
- Breather can be fitted if required
- Smooth external contours
- Low loss uncut wound core
- Single point fixing

Send for publication TF/243A to:

The ENGLISH ELECTRIC Company Limited,
Transformer Sales & Contracts Section,
East Lancashire Road, Liverpool, 10

'ENGLISH ELECTRIC'

rural transformers

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2.

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

TFL.37

A

A Vital contribution to Atomic Power . . .

"WANDLESIDE"

ARMOURED CABLE

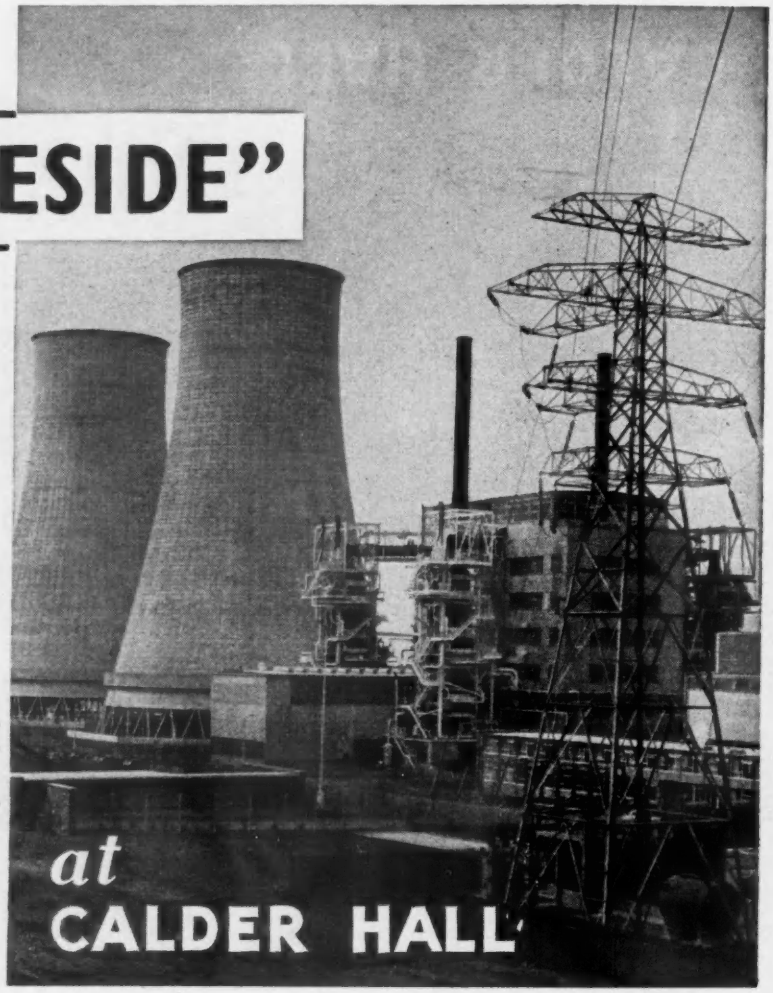
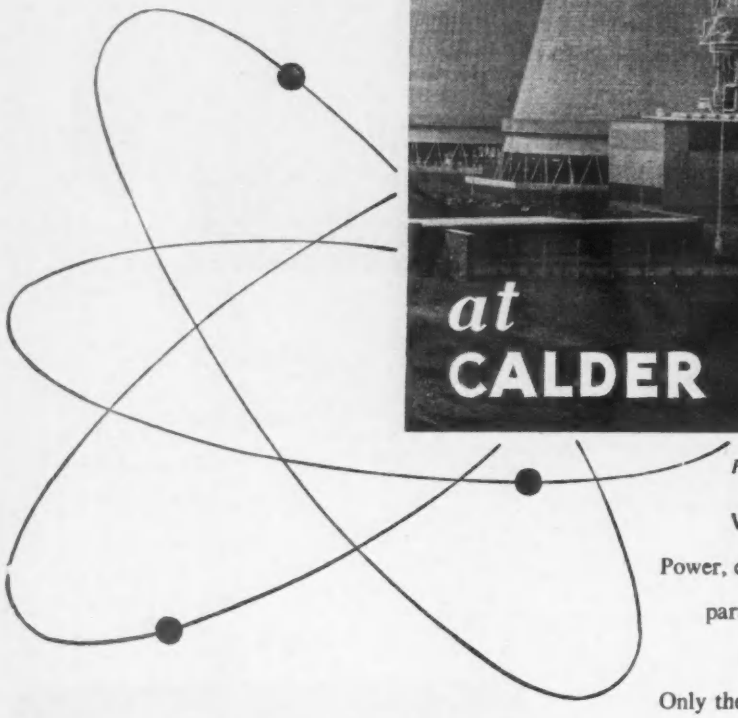


Photo by courtesy U.K. Atomic Energy Authority



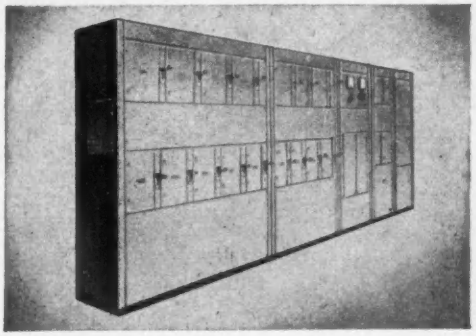
With the advancement of Atomic Power, cables must play an important part in the efficiency and reliability in the production of Nuclear Energy. Only the best is good enough and Wandleside Cables are eminently suitable.

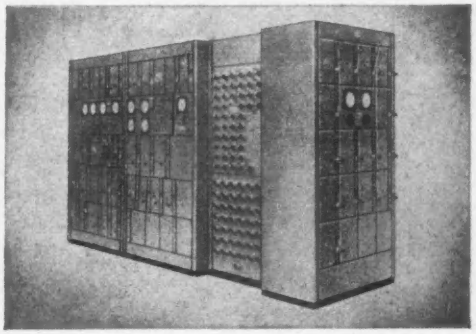
WANDLESIDE CABLES *for Nuclear Energy*

WANDLESIDE CABLE WORKS LTD. 106 GARRATT LANE WANDSWORTH LONDON, S.W.18
One of the FALKS Group
Telephone: VANdyke 7544 (7 lines) *Telegrams: Wandleside, London*

You cannot buy better gear

The Modern Switchgear - for Modern Buildings





MAJESTIC MEDIUM VOLTAGE SWITCHBOARDS ARE BEING SPECIFIED WITH EVERY CONFIDENCE BY LEADING ARCHITECTS, CONSULTING ENGINEERS, ELECTRICITY BOARDS AND INSTALLATION ENGINEERS FOR MODERN TECHNICAL COLLEGES, HOSPITALS, CIVIC AND INDUSTRIAL BUILDINGS.

★ WRITE FOR A COPY OF OUR LATEST BROCHURE MVS.460.

BILL SWITCHGEAR LTD
BIRMINGHAM·20

LONDON, S.W.1 A. W. ZELLEY, N. PAYNE, R. W. HANKINSON GILLINGHAM ST.

MIDLANDS G. H. GARBETT, H. WILLIAMS HEAD OFFICE

NORTH MIDLANDS C. G. BACHELOR HEAD OFFICE

EAST MIDLANDS J. A. PEARCE, HEAD OFFICE

BRISTOL, 3 W. L. WHITE, CHURCH LANE

LEEDS, 14. N. SHARPLES, G. SUTTON, WOODLANDS FACTORY.

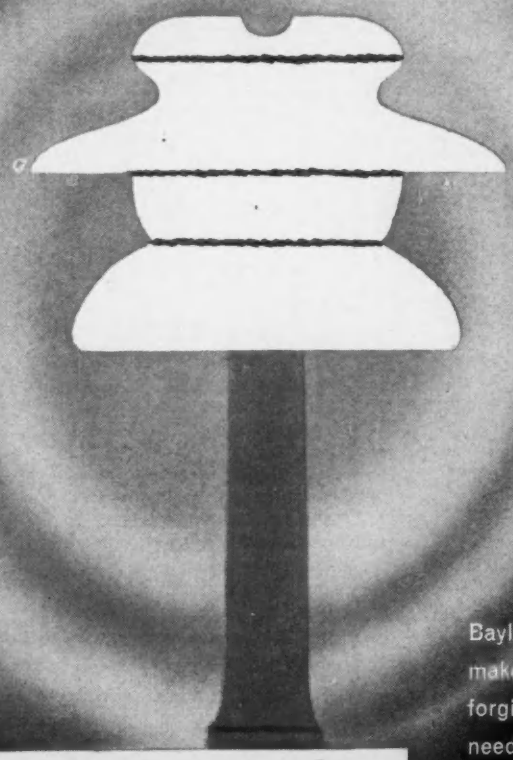
CHELTENHAM C. GEARING, HIGH ST.

MANCHESTER 3 H. H. POLLARD, J. H. RAMSAY, F. A. MAYOR, WOOD STREET

GLASGOW J. D. HARRIS, SANDYFORD PLACE

BELFAST J. BALLENTINE DONEGALL ST.

BJB CARRY POWER ACROSS THE WORLD

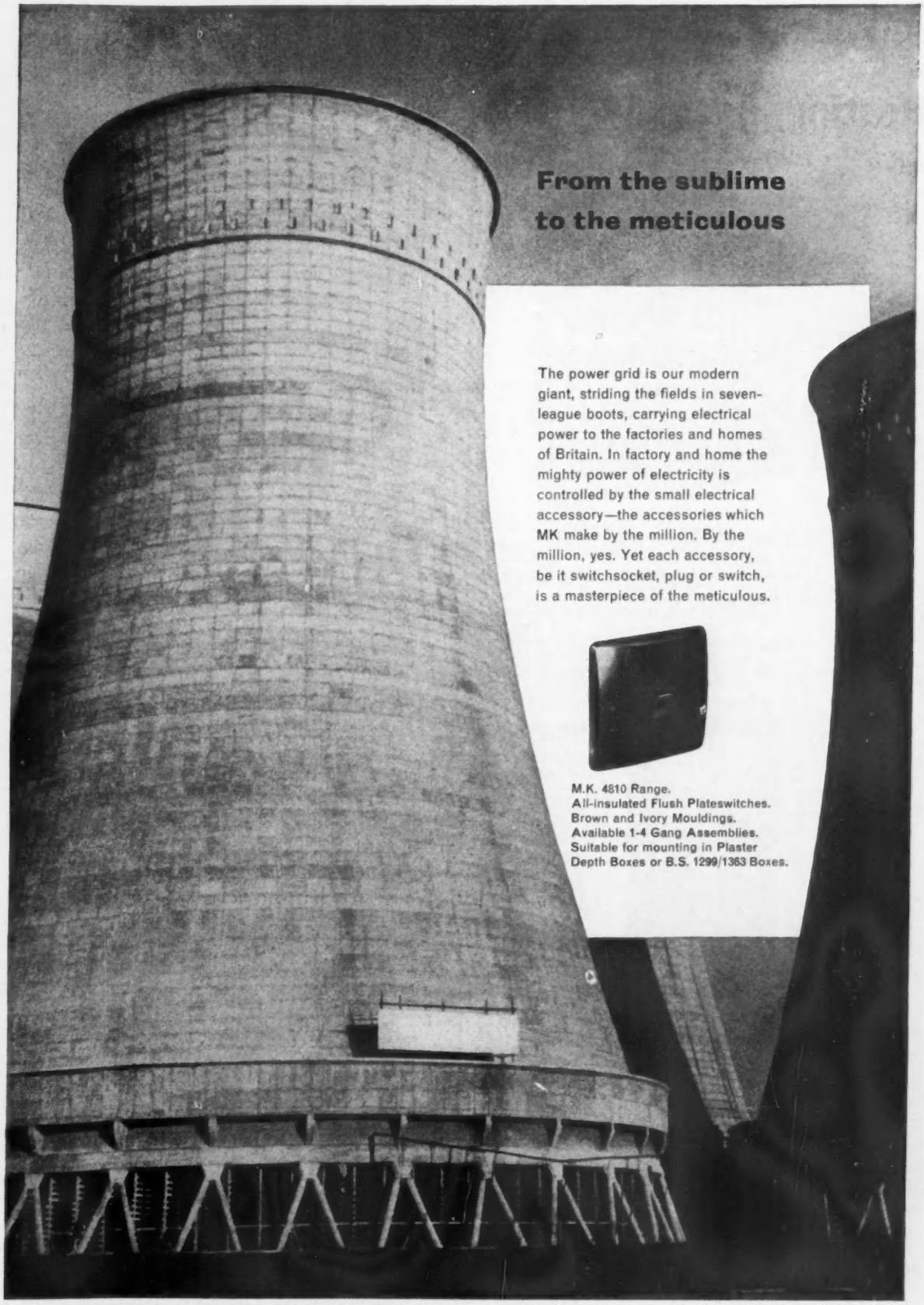


Bayliss, Jones and Bayliss make all the galvanised forgings and steelwork needed for safe, efficient transmission lines—whether it's a local distribution circuit or a high voltage network—and their equipment is used by Electricity Authorities all over the world. *Most standard items can be delivered from stock.*

BAYLISS, JONES & BAYLISS LTD

HEAD OFFICE: VICTORIA WORKS, WOLVERHAMPTON · TELEPHONE: WOLVERHAMPTON 20441

LONDON OFFICE: 139 CANNON STREET, E.C.4. · TELEPHONE: MANSION HOUSE 8524



From the sublime to the meticulous

The power grid is our modern giant, striding the fields in seven-league boots, carrying electrical power to the factories and homes of Britain. In factory and home the mighty power of electricity is controlled by the small electrical accessory—the accessories which MK make by the million. By the million, yes. Yet each accessory, be it switchsocket, plug or switch, is a masterpiece of the meticulous.

M.K. 4810 Range.
All-insulated Flush Plateswitches.
Brown and Ivory Mouldings.
Available 1-4 Gang Assemblies.
Suitable for mounting in Plaster Depth Boxes or B.S. 1299/1363 Boxes.

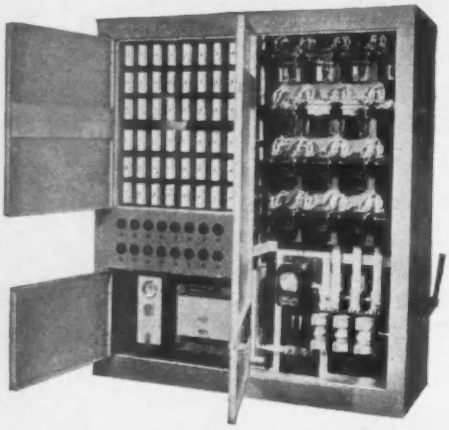
M.K. ELECTRIC LIMITED, SHRUBBERY ROAD, LONDON N.9. TEL: EDMONTON 5151

MK 180 DH.5

BKS

Heating Control Panels

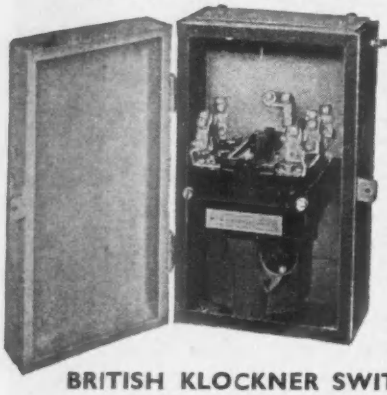
built to individual Specifications



THERMAL STORAGE HEATING

With the special off-peak tariffs now available through the electricity authorities the overall cost of thermal storage space heating has been reduced to a most economical figure. We are specialists in the design and manufacture of automatic panels for space heating control and have supplied panels handling up to 500 kW.

The panel illustrated handles 267 kW and is divided into 16 zones with individual limit thermostats and overall control by time-switch, together with anticipatory control unit. We shall be most happy to quote for your automatic control panel.



CONTACTORS

Comprehensive range of contactors for all types of thermal storage and space heating control—10 to 350 amp. SINGLE, DOUBLE, TRIPLE AND FOUR POLE.

FOR SILENT OPERATION. All models can be fitted with D.C. operating coil and rectifier.

Type D10 60. 4-Pole, 60-Amp, in steel housing.

BRITISH KLOCKNER SWITCHGEAR LTD.

Head Office and Works: Chertsey, Surrey

Telephone: Chertsey 3467. Telegrams: Switchgear, Chertsey.

Branches at Manchester, Glasgow, Newcastle, Midlands and Eire

Agents Throughout the World

post this coupon TODAY!

To BRITISH KLOCKNER SWITCHGEAR LIMITED
Chertsey, Surrey.

Please send me your list of Contactors for Heating Control.

NAME _____

POSITION _____

FIRM _____

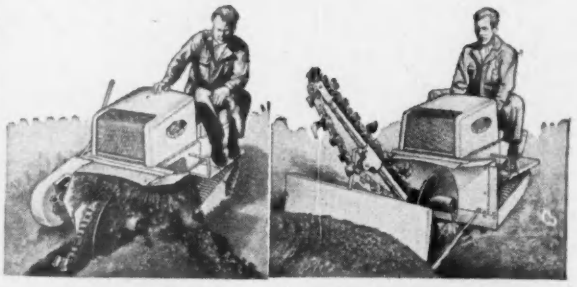
ADDRESS _____

ET/25/8/60

IT'S HERE

The trencher you've been waiting for

The ALLEN 3/12



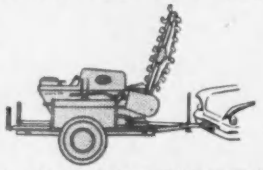
DIGGING **BACKFILLING**

This versatile small trencher and backfiller will dig trenches 3" to 4" wide, down to 5' 6" deep, or 12" wide to 2' 6" deep, with a range of intermediate width and depth capacities. The digging boom is controlled hydraulically, and can be telescoped to suit the depth of trench. It is powered by a 12½ h.p. 4-stroke engine.

The **ALLEN 3/12** is ideal for builders, plumbers, public works contractors, telephone, water, gas and electrical undertakings, etc., and offers speedy, low-cost, mechanical trenching and backfilling for an almost endless variety of jobs.

The **ALLEN 3/12** is approximately 6' 4" long, 3' 1"wide, 3' 1" high and weighs 1,350 lbs.

For transportation from site to site, a specially designed trailer is available, with tilting platform for easy loading.



Fill in and post the coupon below for full details of this superb machine.

ALLEN

To: JOHN ALLEN & SONS (Oxford) LTD COWLEY, OXFORD, ENGLAND

Please send full details of the ALLEN 3/12 Trencher

Name .....

Address .....

9 ..... Tel. .....

this booklet means business ...for YOU!

Every factory employing 20 or more is required by the Factory Act to provide means of giving audible warning (throughout the building) in case of fire.

This booklet gives potential users a simple outline of the type of fire alarm equipment the average factory needs to comply with the Act.

By writing to Gents you can obtain copies for interested customers. This can result in useful business for *you*. Business you can handle with every confidence.*

Ask for Book 1 Section 3F.

**Specialist technicians are at your service to advise on any particularly knotty problem.*

GENTS
OF LEICESTER

FIRE ALARMS

MANUAL CONTACTS · BELLS · INDICATORS
AUTOMATIC DETECTORS · SYRENS · RELAYS
— and 'know how'!

GENT & COMPANY LIMITED · FARADAY WORKS · LEICESTER
London Office and Showroom: 47 Victoria Street, S.W.1.
Also at: BIRMINGHAM · BRISTOL · EDINBURGH · GLASGOW · NEWCASTLE · BELFAST

ELEPHANTIDE

REGISTERED

The

BRITISH MADE

PRESSBOARD

INSULATION

for

TRANSFORMERS

SWITCHGEAR

MOTORS

and all other

ELECTRICAL

APPARATUS

B. S. & W. WHITELEY Ltd

POOL-in-WHARFEDALE, YORKS

Telegrams: "Whiteley, Pool-in-Wharfedale"

Telephone: Arthington 2121

LONDON OFFICE: 104 HIGH HOLBORN, W.C.1

Telephone: CHAncery 7646

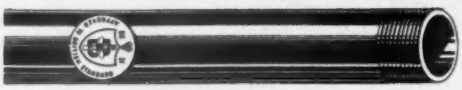
SUPER

STEEL CONDUIT

TO B.S. 31

A Nation Wide Service

. . . from five industrial centres strategically placed to give immediate attention to customers' requirements in all parts of the country. Burn conduit, made to an unvarying high quality, is furnace welded for easier bending. Light and heavy gauges are available in a full range of diameters $\frac{3}{8}$" to $2\frac{1}{2}$" and a variety of finishes. Write now for the name of your nearest wholesaler.



EDINBURGH	*33 Westgarth Avenue, Edinburgh 13* *Telephone: Colinton 88113*
LIVERPOOL	*24 Chapel Street, Liverpool 2* *Telephone: Central 7012*
BIRMINGHAM	*City Tube & Conduit Mills, Smethwick, Birmingham* *Telephone: Smethwick 1511 (5 lines)*
LONDON	*2 Deansway, London N.2* *Telephone: Tudor 7287*
EASTERN COUNTIES	*23 Church Road, Kelvedon, Colchester, Essex* *Telephone: Kelvedon 267*

GEORGE BURN LIMITED

GEORGE BURN LTD.

City Tube & Conduit Mills, Smethwick, Birmingham.

Telephone: Smethwick 1511 (5 lines)

GB48

Two New Water Heater Control Switches

Volex

20 Amp. and 30 Amp.
SURFACE MOUNTING
BROWN OR CREAM FINISH

D.P. INSULATED SWITCHES
WITH EARTH TERMINAL

WITH SELF-CONTAINED MOUNTING BLOCKS

20 AMP. A.C.

V/5303	Without Pilot light ...	6/8d. each
V/5303CR	„ „ Cream	7/8d. „
V/5304	With Pilot light	9/- „
V/5304CR	„ „ Cream	10/- „

30 AMP. A.C.

V/5203	Without Pilot light ...	7/8d. each
V/5203CR	„ „ Cream	8/8d. „
V/5204	With Pilot light ...	10/- „
V/5204CR	„ „ Cream	11/- „

VOLEX ELECTRICAL PRODUCTS LTD.

Telephone: PENDLETON 4373 SALFORD 6 Telegrams: VOLEXPROD, Salford 6

ZENITH
(REGD. TRADE-MARK)

PHASE SHIFTING TRANSFORMER

This instrument provides convenient means for adjusting the phase angle or power factor in alternating current circuits when testing single or polyphase service meters, wattmeters, or power factor indicators, etc. It is also the simplest means for teaching and demonstrating Alternating Current Theory as affecting phase angle and power factor.

Illustrated brochure free on request

THE ZENITH ELECTRIC COMPANY LTD.

ZENITH WORKS, VILLIERS ROAD, WILLESDEN GREEN, LONDON, N.W.2

Telephone: WILlesden 6561-5 Telegrams: Voltaohm, Norphone, London

MANUFACTURERS OF ELECTRICAL EQUIPMENT INCLUDING RADIO AND TELEVISION COMPONENTS

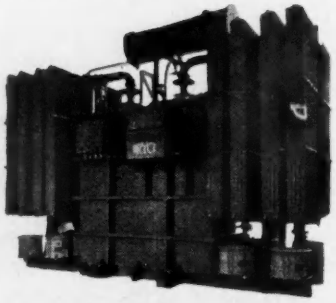
Radiators Type "TRAFO 9" With acknowledgements to G.E.C. Ltd.

...Proved in Service

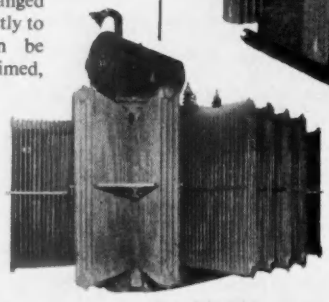
WASHINGTON COOLING RADIATORS

FOR TRANSFORMERS RECTIFIERS AND REGULATORS

Washington Transformer Radiators are made to any size with either flanged couplings or for welding directly to the tank wall. They can be delivered phosphated and primed, finish painted or galvanized to meet specific needs. Their design allows free air passage at top and bottom of radiator and makes them suitable for air-blast from underneath. Further details on request.



Radiators Type "TRAFO 9" With acknowledgements to Bryce Electric Construction Co. Ltd.



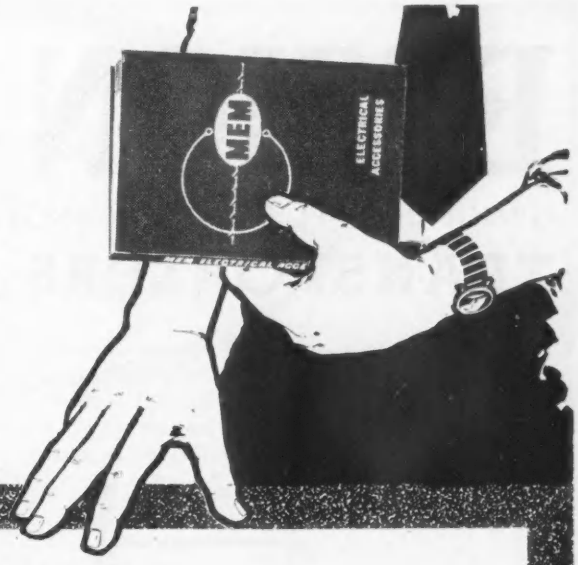
Radiators Type "TRAFO 858" With acknowledgements to Sturdy Electric Co. Ltd.

Radiators Type "TRAFO 9" With acknowledgements to C. A. Parsons & Co. Ltd.

WASHINGTON ENGINEERING LIMITED

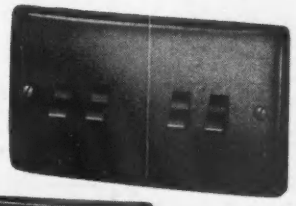
WASHINGTON · CO. DURHAM · ENGLAND.
Tel: Washington 2362/3 Grams: Wearco, Washington Station

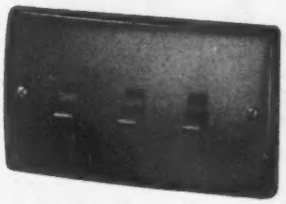
Electrical accessories from the MEM range

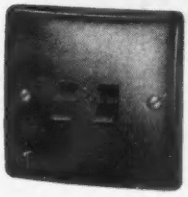


MEM "TAY" flush plate/switches and bell pushes

- All insulated. Current carrying parts mounted on high-grade vitreous porcelain.
- Solid Silver contacts.
- Modern styling eliminates dust traps.
- Plate and switch form a one-piece unit, self adjusting to varying plaster levels.
- Brown or ivory finish.


724 TFB

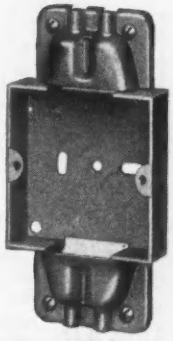

723 TFB

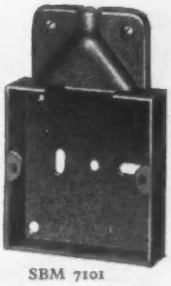

722 TFB

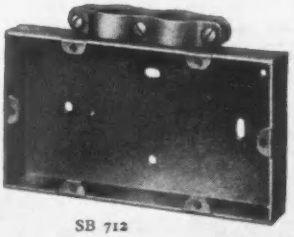
71 TFB

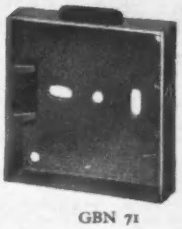
MEM "TAY" plaster depth boxes

- Wood, moulded and steel.
- Steel boxes available with insulated lugs adjustable for alignment.
- A range of steel boxes available with special clamps for M.I.C.C. cables.


SBM 7122


SBM 7101


SB 712


GBN 71

The full range is detailed in the new 88-page catalogue. Write for your copy today, list No. 435T

MIDLAND ELECTRIC MANUFACTURING CO. LTD., REDDINGS LANE, TYSELEY, BIRMINGHAM 11

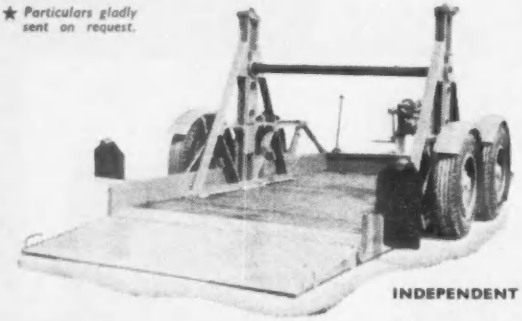
EEZION

GROUND LEVEL ON/OFF LOADING

TRANSPORTERS

MADE in 4-types: Independent, Tractor Operated, Articulated and Tilting Platform to accommodate a wide variety of loads and capable of transporting weights between 15 cwts and 25 tons. EEZIONS will do your job in less time and with less labour. Models suitable for every duty in the Electrical Industry.

★ *Particulars gladly sent on request.*



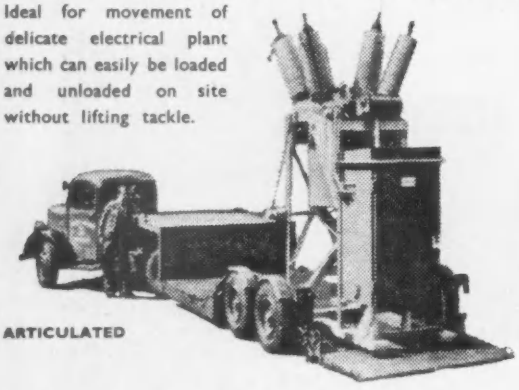
INDEPENDENT

SAFE SPEEDY and ECONOMICAL

IN USE BY
H.M. SERVICES
GOVERNMENT DEPARTMENTS
PUBLIC AUTHORITIES
and leading
INDUSTRIAL COMPANIES

(Above) This CABLE DRUM and TRANSFORMER CARRIER is designed for loads of 3¾ tons and 5¾ tons. "A" frames are an optional fitment and when removed add to the versatility of the carrier. Shown here at ground level the retractable undercarriage is raised hydraulically to travelling height.

(Below) ARTICULATED type for loads of 3, 5, 7 and 10 tons. Ideal for movement of delicate electrical plant which can easily be loaded and unloaded on site without lifting tackle.



ARTICULATED

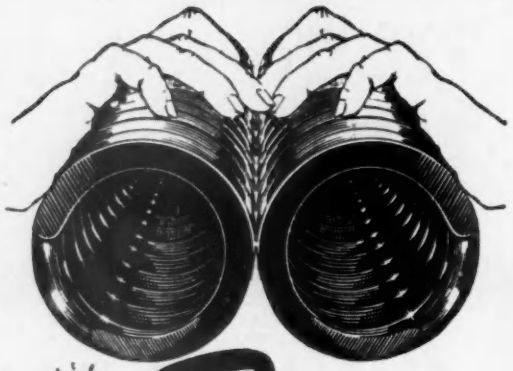
SOLE DISTRIBUTORS AND MANUFACTURERS:

IBBETT ENGINEERING CO. LTD.

KEMPSTON HARDWICK · BEDFORD

Telephone : Telegrams : Cables : KEMPSTON 2341/2

Looking in the right direction



Ratcliffe

SPRINGS

F. S. RATCLIFFE (ROCHDALE) LTD.,
Crawford Spring Works, Norman Road, Rochdale
Phone: Rochdale 40415 **'Grams: Recoil, Rochdale**
Telex 63178

CW5968/1

THE

"54"

DRAWER UNIT

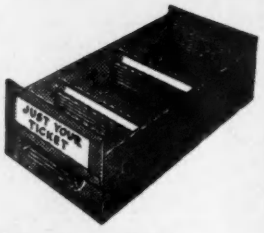
ALL STEEL
Stove Enamelled
DARK GREEN

•

OVERALL SIZE
42" HIGH
36" WIDE
12" DEEP

•

Contains 54 of these drawers, each 5" wide, 3" high, 11¼" long, 54 dividers and 54 drawer cards with each unit.
Extra dividers 6d. each.



£18 DELIVERED FREE to ENGLAND, SCOTLAND and WALES

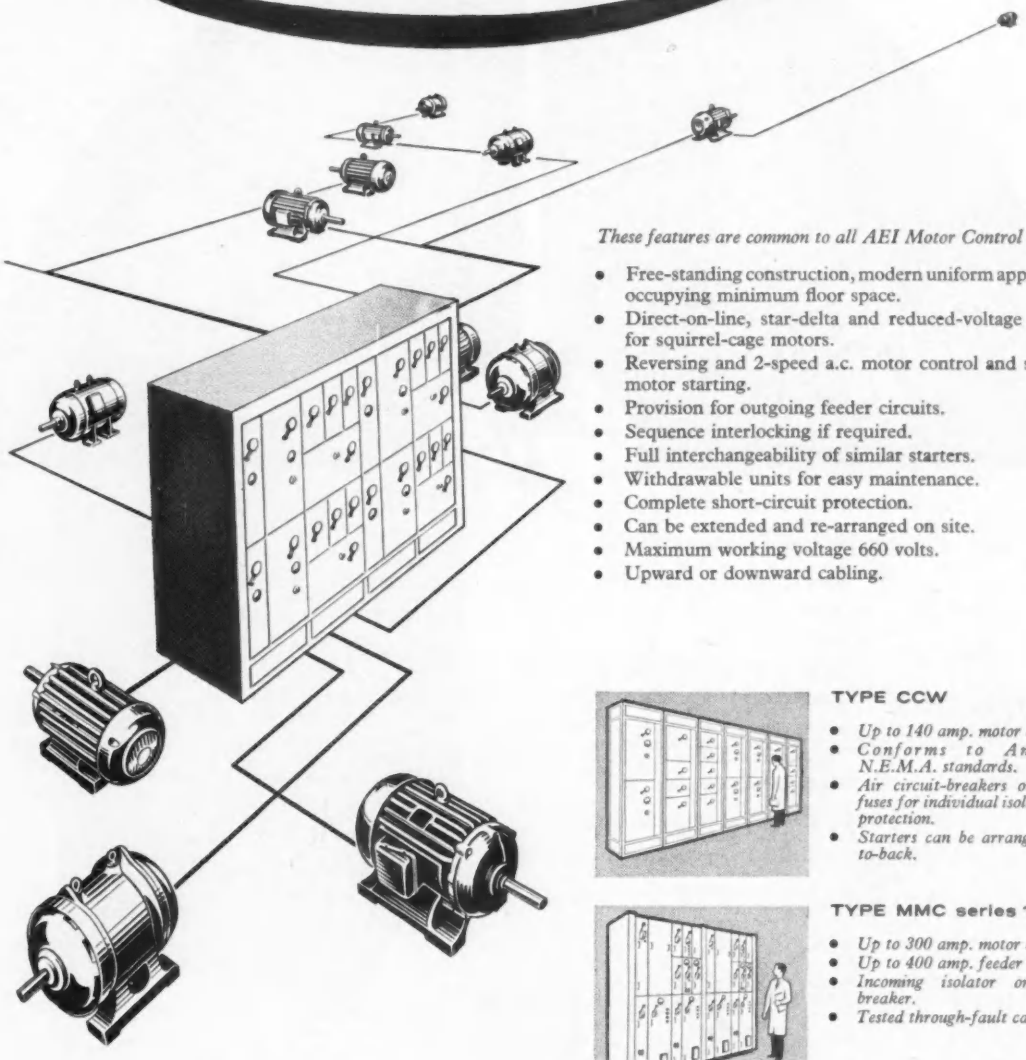
SEND FOR SAMPLE DRAWER

N. C. BROWN LTD.

E.T. WING . HEYWOOD · LANCS.

Telephone: Heywood 69018 (6 lines)

So many advantages with AEI Multi-motor control

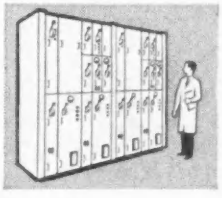


These features are common to all AEI Motor Control Centres:

- Free-standing construction, modern uniform appearance, occupying minimum floor space.
- Direct-on-line, star-delta and reduced-voltage starting for squirrel-cage motors.
- Reversing and 2-speed a.c. motor control and slip-ring motor starting.
- Provision for outgoing feeder circuits.
- Sequence interlocking if required.
- Full interchangeability of similar starters.
- Withdrawable units for easy maintenance.
- Complete short-circuit protection.
- Can be extended and re-arranged on site.
- Maximum working voltage 660 volts.
- Upward or downward cabling.

TYPE CCW

- *Up to 140 amp. motor circuits.*
- *Conforms to American N.E.M.A. standards.*
- *Air circuit-breakers or switch-fuses for individual isolation and protection.*
- *Starters can be arranged back-to-back.*



TYPE MMC series 1000

- *Up to 300 amp. motor circuits.*
- *Up to 400 amp. feeder circuits.*
- *Incoming isolator or circuit breaker.*
- *Tested through-fault capacity.*

AEI

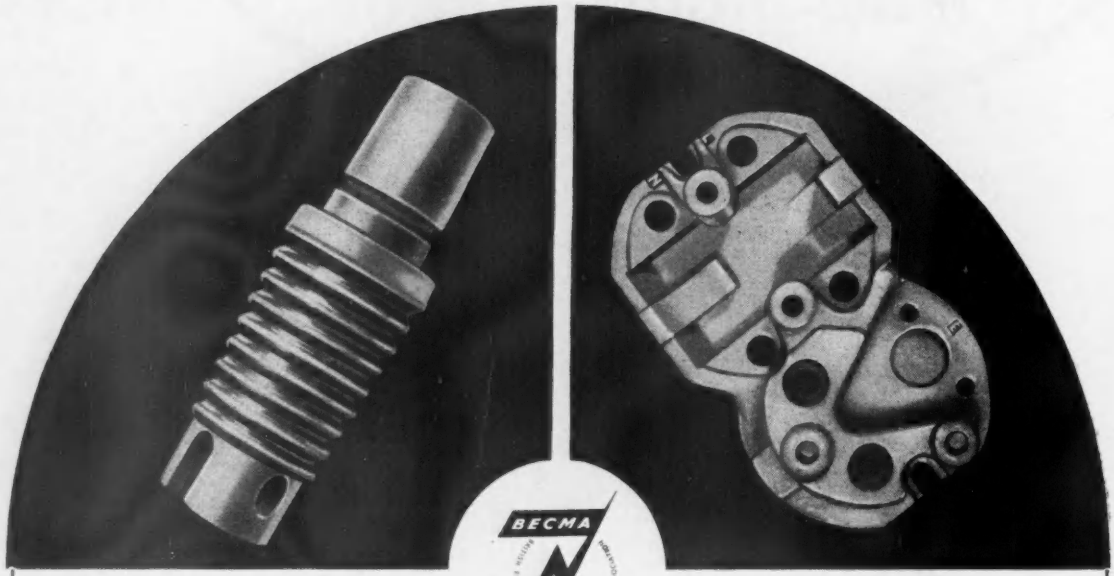
Associated Electrical Industries Limited
Motor and Control Gear Division
RUGBY AND MANCHESTER

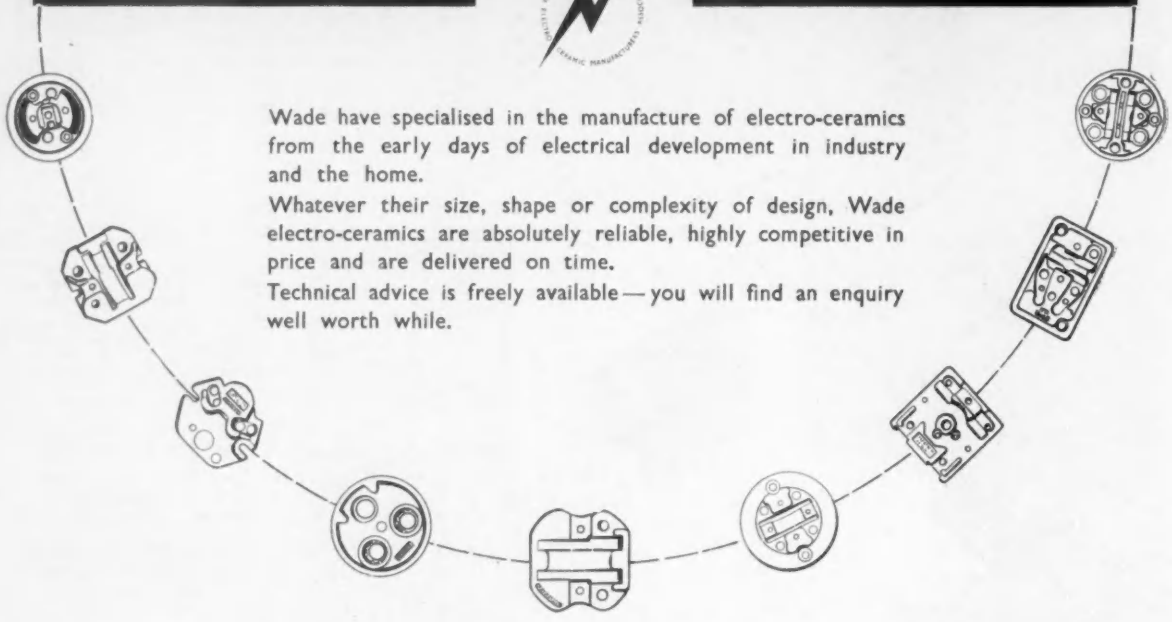
A5530

COMBINING THE MOTOR AND CONTROL GEAR INTERESTS OF BTH AND M-V

WADE

ELECTRO-CERAMICS





Wade have specialised in the manufacture of electro-ceramics from the early days of electrical development in industry and the home.

Whatever their size, shape or complexity of design, Wade electro-ceramics are absolutely reliable, highly competitive in price and are delivered on time.

Technical advice is freely available—you will find an enquiry well worth while.

PORCELAIN FOR INSULATION . . . . . WADE FOR PORCELAIN

GEORGE WADE & SON LTD., BURSLEM, STOKE-ON-TRENT.
WADE (ULSTER) LTD., PORTADOWN, NORTHERN IRELAND.

Members of the WADE Group of Potteries.

PROTECTION...

Reyrolle ANNOUNCE A NEW PILOT-WIRE SYSTEM

Solkor-R

HIGH-SPEED FEEDER-PROTECTION

This system is a major advance in the art of feeder protection. It combines the most recent results of protection research with principles which have been well proved in service. Requiring only a single-pole relay and lightly insulated 2-core pilots it is both simple and economical to install, and, being based on static components, its maintenance costs are negligible.

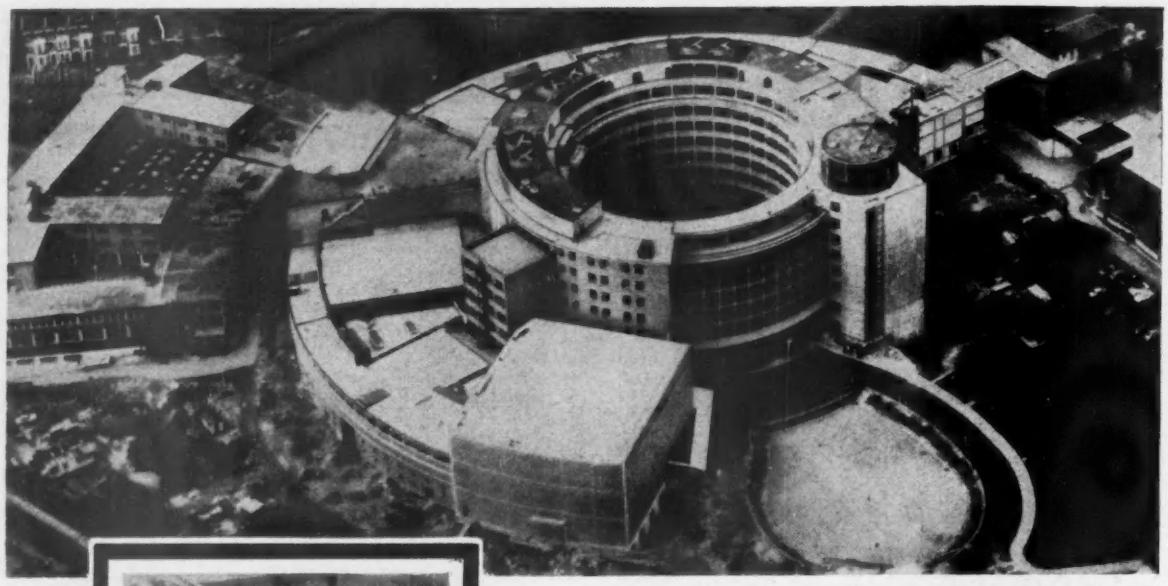
Other features are high-speed operation, high transient stability, low fault-settings, use of ordinary current-transformers, and suitability for pilots up to 1,000 ohms resistance.

Ask for Pamphlet No. 1328

Reyrolle

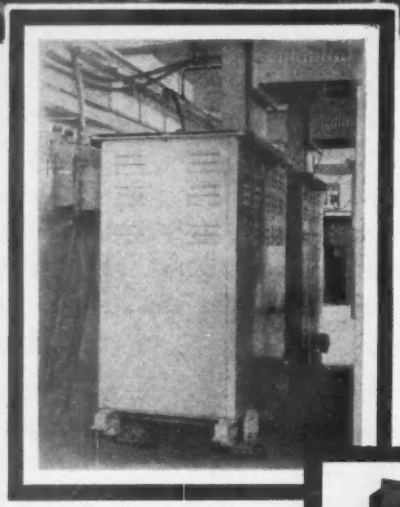
A. REYROLLE & COMPANY LIMITED - HEBBURN - COUNTY DURHAM - ENGLAND

BRUSH at the B·B·C

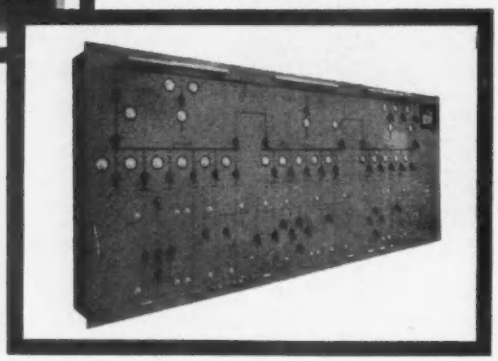


Photograph by kind permission of the B.B.C.

The newly opened B.B.C. Television Centre at the White City consumes considerable electric power and requires a safe and dependable supply. Brush Control panels have been chosen for the three control rooms located within the studio area, controlling both 11 kV and 415 volt supplies. Brush have also supplied nine 750-kVA Transformers housed in Substations on the periphery of the new circular building. These dry type Transformers with class 'C' insulation rely on surrounding air as the sole cooling medium and are able to withstand temperatures in excess of 180°C continuously.



Two of the nine 750 kVA distribution Transformers.



Brush Control Panel in the Central Apparatus Room.

BRUSH TRANSFORMERS and SWITCHGEAR

BRUSH ELECTRICAL ENGINEERING CO. LTD. · LOUGHBOROUGH · ENGLAND *A member of the Hawker Siddeley Group*

NEWS SHEET

42-hour week for contracting electricians, equivalent to wage increase of 3d/hr. for journeymen. Time per day to be fixed by employers. New agreement to cut out time wasting, respect strict starting, stopping times. (289)

400 kV line reactors ordered by Sweden, notable step forward in ensuring large system stability. Reactors will be rated 150 MVAr with reactance in each phase balanced to 0·5%. (272)

Operation at liquid helium temperature is way to higher computer speeds predicts Elliott Bros. manager. Further advances possible through miniaturisation involving fine-pattern etching of magnetic films. (266, 282)

Exports of domestic electrical appliances 17½% up on last year, claims BEAMA in report on first six months 1960. Of all electrical exports, 10% went to ECM countries, 7% to EFTA members, 60% to Commonwealth. (289)

7,770 million units generated during July, only slightly below June figure, with marked increases over last year in southern areas. First 120 MW set at Staythorpe B commissioned. (288)

Company changes—Hartley Electromotives acquired by James Austin and Sons for £218,300 (289) . . . Combined Electrical Manufacturers is holding company in merger of S. and C. with Hackbridge and Hewittic (293) . . . Gresham Developments and Lion Electronic (same ownership) combine to form Gresham-Lion Electronics Ltd. . . . Aish and Co., Bournemouth electrical contractors acquired by J. J. Allen for £217,000. (289)

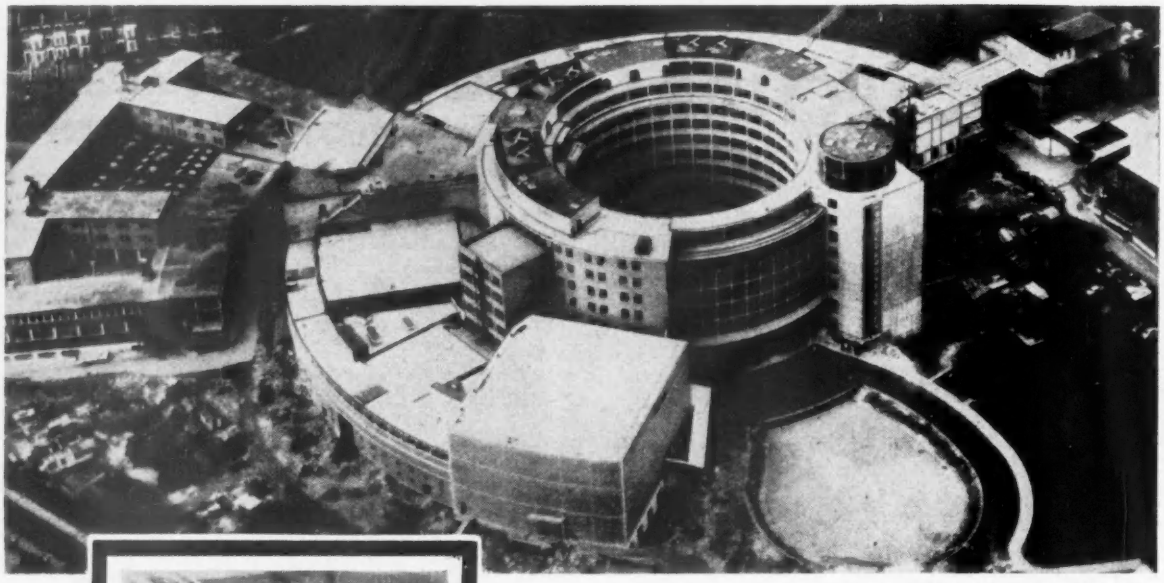
Are simple fluorescent fittings suitable for classroom lighting? Correspondents debate technical and aesthetic factors in Blackpool school lighting practice. (273)

40 kW linear accelerator to be built by US Bureau of Standards. Output power said to be 100,000 times that of existing high energy accelerators. (276)

ECA evidence to Moloney Consumer Protection Committee called for restrictions on general public obtaining accessories and for electrical installation work. (291)

PEOPLE—P. T. Menzies appointed part-time member CEGB in succession to G. A. S. Nairn who is retiring; Lord Geddes re-elected part-time member (280, 281) . . . Sir Joseph Latham elected director AEI, in place of Viscount Head, retired; C. R. Wheeler appointed additional vice-chairman, AEI, to take up executive duties in 1962 . . . J. Banks promoted chief engineer, power cables division, BICC . . . F. A. Clifton succeeds S. W. Hayes (retiring) as manager, AEI private telephone dept., Birmingham. . . . F. J. Burn appointed deputy chairman, Dubilier Condenser, (280, 281)

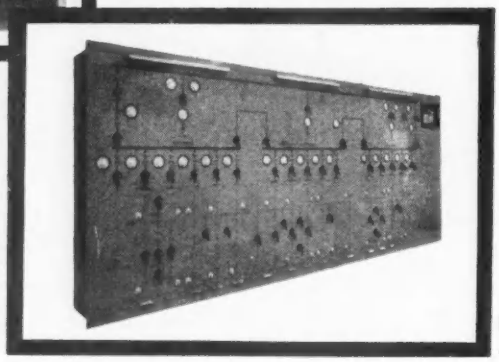
BRUSH at the B·B·C



Photograph by kind permission of the B.B.C.

The newly opened B.B.C. Television Centre at the White City consumes considerable electric power and requires a safe and dependable supply. Brush Control panels have been chosen for the three control rooms located within the studio area, controlling both 11 kV and 415 volt supplies. Brush have also supplied nine 750-kVA Transformers housed in Substations on the periphery of the new circular building. These dry type Transformers with class 'C' insulation rely on surrounding air as the sole cooling medium and are able to withstand temperatures in excess of 180°C continuously.

Two of the nine 750 kVA distribution Transformers.



Brush Control Panel in the Central Apparatus Room.

BRUSH TRANSFORMERS and SWITCHGEAR

BRUSH ELECTRICAL ENGINEERING CO. LTD. · LOUGHBOROUGH · ENGLAND *A member of the Hawker Siddeley Group*

NEWS SHEET

42-hour week for contracting electricians, equivalent to wage increase of 3d/hr. for journeymen. Time per day to be fixed by employers. New agreement to cut out time wasting, respect strict starting, stopping times. (289)

400 kV line reactors ordered by Sweden, notable step forward in ensuring large system stability. Reactors will be rated 150 MVAr with reactance in each phase balanced to 0·5%. (272)

Operation at liquid helium temperature is way to higher computer speeds predicts Elliott Bros. manager. Further advances possible through miniaturisation involving fine-pattern etching of magnetic films. (266, 282)

Exports of domestic electrical appliances 17½% up on last year, claims BEAMA in report on first six months 1960. Of all electrical exports, 10% went to ECM countries, 7% to EFTA members, 60% to Commonwealth. (289)

7,770 million units generated during July, only slightly below June figure, with marked increases over last year in southern areas. First 120 MW set at Staythorpe B commissioned. (288)

Company changes—Hartley Electromotives acquired by James Austin and Sons for £218,300 (289) . . . Combined Electrical Manufacturers is holding company in merger of S. and C. with Hackbridge and Hewittic (293) . . . Gresham Developments and Lion Electronic (same ownership) combine to form Gresham-Lion Electronics Ltd. . . . Aish and Co., Bournemouth electrical contractors acquired by J. J. Allen for £217,000. (289)

Are simple fluorescent fittings suitable for classroom lighting? Correspondents debate technical and aesthetic factors in Blackpool school lighting practice. (273)

40 kW linear accelerator to be built by US Bureau of Standards. Output power said to be 100,000 times that of existing high energy accelerators. (276)

ECA evidence to Moloney Consumer Protection Committee called for restrictions on general public obtaining accessories and for electrical installation work. (291)

PEOPLE—P. T. Menzies appointed part-time member CEGB in succession to G. A. S. Nairn who is retiring; Lord Geddes re-elected part-time member (280, 281) . . . Sir Joseph Latham elected director AEI, in place of Viscount Head, retired; C. R. Wheeler appointed additional vice-chairman, AEI, to take up executive duties in 1962 . . . J. Banks promoted chief engineer, power cables division, BICC . . . F. A. Clifton succeeds S. W. Hayes (retiring) as manager, AEI private telephone dept., Birmingham. . . . F. J. Burn appointed deputy chairman, Dubilier Condenser, (280, 281)

NEWS SHEET

Fast excitation for large turbo-alternators discussed with reference to English Electric equipment by N. H. Shaw. Advantages stressed of automatically limiting megavar output to improve stability. (267)

Refrigerator sales by area boards up 13·4% in June on previous June; most other appliances heavily down, washing machines by 50%. (290)

American supply companies look to home heating as major load builder. Accent placed on built-in electric heating as part of all-electric home. (265)

Stagnant pool for solar heat collection suggested by Israel scientist, with output possibilities of 6 MW/sq km of surface. (290)

Increasing competition in cathode ray tubes. New company aims to produce tubes at least 15s less than existing list prices. (292)

Phasing-out tests on e.h.v. cables described using simple methods, also with voltage transformers and insulated test rods with high resistance connection to electrostatic voltmeter. (275)

Fixed price tendering may be proving costly for electrical contractors; tenders should include a margin for increased cost contingencies. (265, 277)

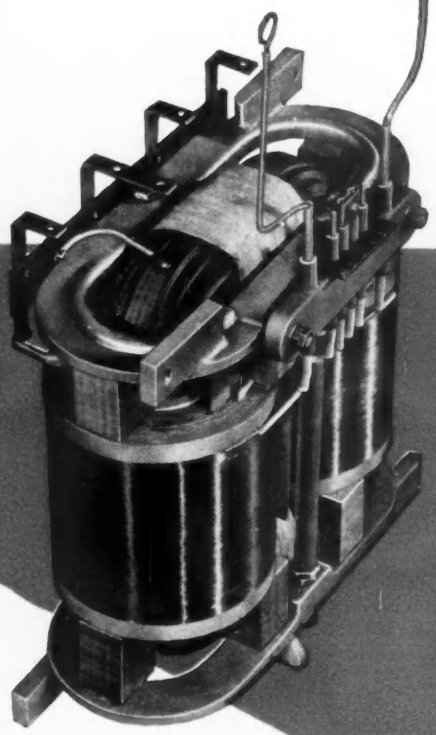
Belfast electricity undertaking to cut some tariffs as result of lower generation costs. 1959-60 report shows 7·69% increase in unit sales, £791,094 net surplus. (293)

BUSINESS—Metal Industries shows rise in trading profit, excluding Lancashire Dynamo figures, which also show slight profit increase . . . Excellent results by Strand Electric lead to dividend increase, but John E. Dallas pay the same on higher profits . . . Radio and Television Trust propose one-for-two scrip issue . . . Hackbridge Holdings make smaller profit but maintain dividend and propose one-for-one scrip issue. (294)

OVERSEAS—Recent World Bank loans: to Ghana for the Volta River scheme, £30m. . . . $25m. for hydro-electric development in Colombia . . . First tubular water turbine installed in Sweden has 4,875 h.p. rating and asynchronous generator . . . Third Swedish nuclear reactor started at Studsvik . . . In Australia, Murray No. 1 station now to be surface built after change of plans . . . Hire-purchase dispute in South Africa . . . Urgent consideration being given to Nkula Falls hydro project in Rhodesia and Nyasaland; also plans for simple supplies to Africans' homes. (278, 279)

RURAL TRANSFORMERS

of advanced Electrical, Thermal and Mechanical Design



Continuous loop core—improved magnetic performance.
Reduced iron and copper losses.
Low hot-spot temperature gradient.
High resistance to line surges.
Great short-circuit strength.

Closed loop core of grain oriented steel.

RATINGS AND VOLTAGES

The transformers are manufactured in a range of five sizes, viz., 5, 10, 15, 25 and 50 kVA and are designed for operating on a single-phase, 50 cycle, 11 kV or 6·6 kV supply.

OVERLOAD CAPACITY

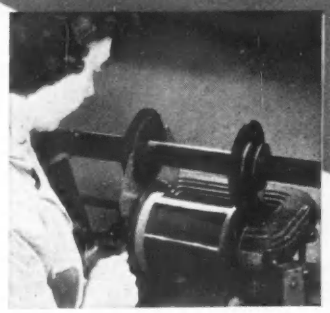
The transformers are capable of withstanding the following overloads for two hours, without injurious heating, following continuous full load with an average ambieht temperature not exceeding 20°C.

5 kVA 100%
10 kVA 45%
15 kVA 25%
25 kVA 15%
50 kVA . . . . . As B.S. 171 and C.P. 1010.

IMPULSE LEVEL

The H.V. windings are designed for the following impulse levels :—

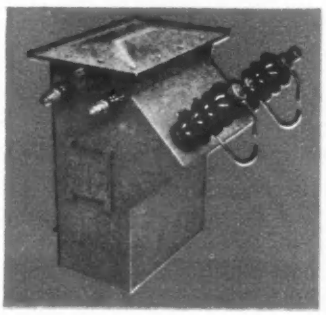
6·6 kV . . . . . 75 kV full wave.
11 kV . . . . . 100 kV full wave.



Winding a high-voltage coil on a closed loop core.

PERFORMANCE

	5 kVA	10 kVA	15 kVA	25 kVA	50 kVA
Magnetising Volt-Amperes (approx.)	30	45	60	90	150
Iron loss at normal voltage (watts)	22	38	49	70	125
Copper loss at normal rating 75°C. (watts)	170	300	420	630	1070



15-kVA transformer showing double-gap arcing horns, and bolted-on domed and flanged cover.

Write for Leaflet No. 523.

BRUCE PEEBLES & CO LIMITED

EDINBURGH

NEWS SHEET

Fast excitation for large turbo-alternators discussed with reference to English Electric equipment by N. H. Shaw. Advantages stressed of automatically limiting megavar output to improve stability. (267)

Refrigerator sales by area boards up 13·4% in June on previous June; most other appliances heavily down, washing machines by 50%. (290)

American supply companies look to home heating as major load builder. Accent placed on built-in electric heating as part of all-electric home. (265)

Stagnant pool for solar heat collection suggested by Israel scientist, with output possibilities of 6 MW/sq km of surface. (290)

Increasing competition in cathode ray tubes. New company aims to produce tubes at least 15s less than existing list prices. (292)

Phasing-out tests on e.h.v. cables described using simple methods, also with voltage transformers and insulated test rods with high resistance connection to electrostatic voltmeter. (275)

Fixed price tendering may be proving costly for electrical contractors; tenders should include a margin for increased cost contingencies. (265, 277)

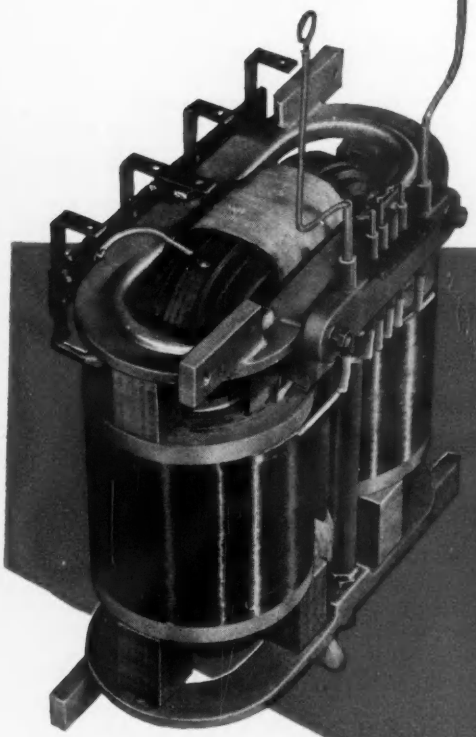
Belfast electricity undertaking to cut some tariffs as result of lower generation costs. 1959-60 report shows 7·69% increase in unit sales, £791,094 net surplus. (293)

BUSINESS—Metal Industries shows rise in trading profit, excluding Lancashire Dynamo figures, which also show slight profit increase . . . Excellent results by Strand Electric lead to dividend increase, but John E. Dallas pay the same on higher profits . . . Radio and Television Trust propose one-for-two scrip issue . . . Hackbridge Holdings make smaller profit but maintain dividend and propose one-for-one scrip issue. (294)

OVERSEAS—Recent World Bank loans: to Ghana for the Volta River scheme, £30m. . . . $25m. for hydro-electric development in Colombia . . . First tubular water turbine installed in Sweden has 4,875 h.p. rating and asynchronous generator . . . Third Swedish nuclear reactor started at Studsvik . . . In Australia, Murray No. 1 station now to be surface built after change of plans . . . Hire-purchase dispute in South Africa . . . Urgent consideration being given to Nkula Falls hydro project in Rhodesia and Nyasaland; also plans for simple supplies to Africans' homes. (278, 279)

RURAL TRANSFORMERS

of advanced Electrical, Thermal and Mechanical Design



Continuous loop core—improved magnetic performance.
Reduced iron and copper losses.
Low hot-spot temperature gradient.
High resistance to line surges.
Great short-circuit strength.

Closed loop core of grain oriented steel.

RATINGS AND VOLTAGES

The transformers are manufactured in a range of five sizes, viz., 5, 10, 15, 25 and 50 kVA and are designed for operating on a single-phase, 50 cycle, 11 kV or 6·6 kV supply.

OVERLOAD CAPACITY

The transformers are capable of withstanding the following overloads for two hours, without injurious heating, following continuous full load with an average ambieht temperature not exceeding 20°C.

5 kVA	100%
10 kVA	45%
15 kVA	25%
25 kVA	15%
50 kVA	As B.S. 171 and C.P. 1010.

Winding a high-voltage coil on a closed loop core.

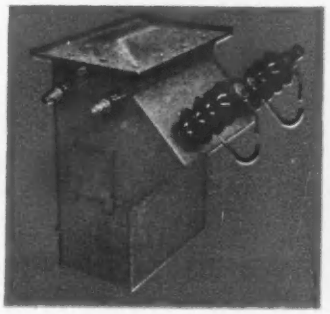
IMPULSE LEVEL

The H.V. windings are designed for the following impulse levels :—

6·6 kV	75 kV full wave.
11 kV	100 kV full wave.

PERFORMANCE

	5 kVA	10 kVA	15 kVA	25 kVA	50 kVA
Magnetising Volt-Amperes (approx.)	30	45	60	90	150
Iron loss at normal voltage (watts)	22	38	49	70	125
Copper loss at normal rating 75°C. (watts)	170	300	420	630	1070



15-kVA transformer showing double-gap arcing horns, and bolted-on domed and flanged cover.

Write for Leaflet No. 523.

BRUCE PEEBLES & CO LIMITED

EDINBURGH

C

BABCOCK

ONCE-THROUGH "SUPERCRITICAL" BOILER

for

DRAKELOW 'C' POWER STATION

DRAKELOW 'C' will be the first Central Electricity Generating Board power station to be equipped with boiler plant operating at supercritical pressure.

The boiler to be supplied by

BABCOCK & WILCOX LTD.

will comprise a 'once-through' unit, pulverized-fuel fired, with an evaporation of

2,500,000 lb./hr.,

with steam conditions of

3,650 lb./sq.in. (s.o.p.)

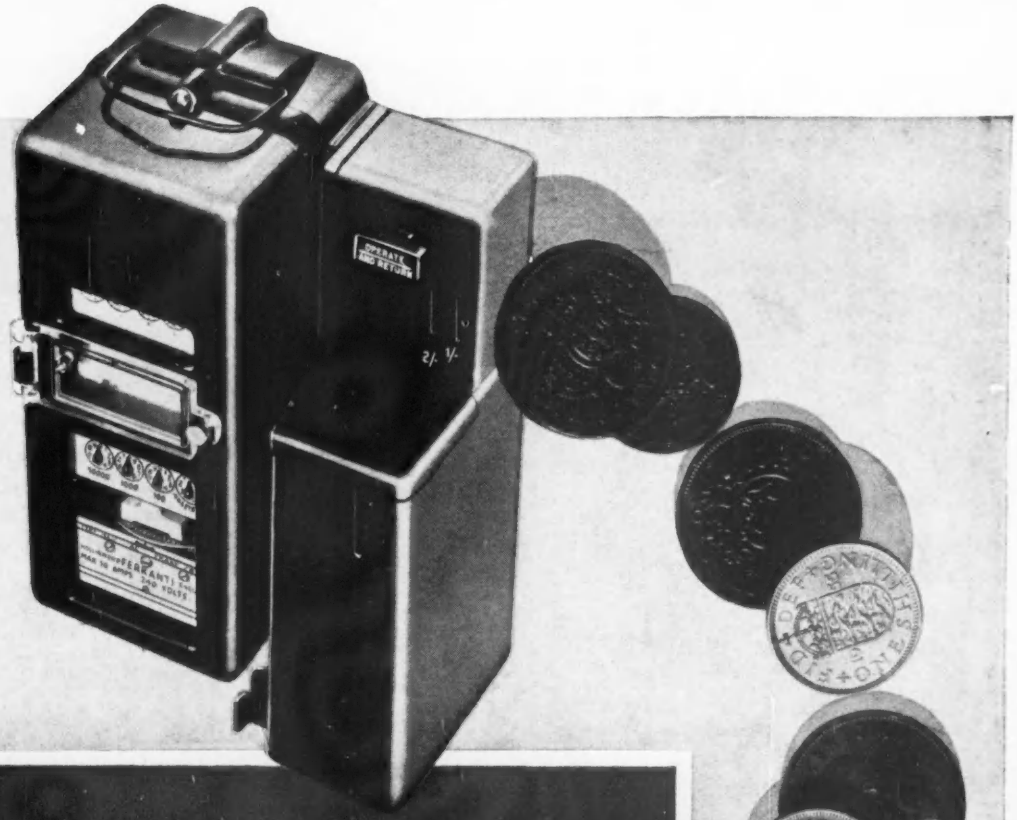
1,110°F

AND REHEAT TO 713 lb./sq. in., 1,055°F, to steam a

375 M.W. GENERATOR

This Company, which is able to draw upon a considerable experience of supercritical-pressure boiler plant in other Babcock installations, is proud to be in the forefront of this important advance, with its potentiality for valuable increases in power station overall thermal efficiencies.

BABCOCK & WILCOX LTD., BABCOCK HOUSE, 209 EUSTON ROAD, LONDON, N.W.I



FERRANTI

FMmP PREPAYMENT METER

For optional or single coin use

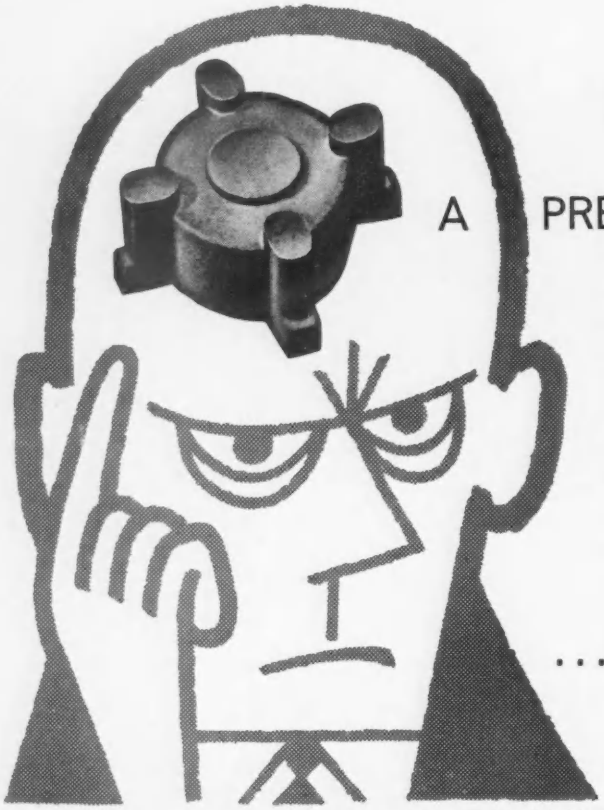
The Ferranti FMmP Prepayment Meter is now available for operation with:-

(a) Shillings only, or
(b) Two-shilling pieces only, or
(c) Shillings or Two-shilling pieces at consumers option.

FERRANTI

FERRANTI LTD · HOLLINWOOD · LANCS Tel: FAIlsworth 2000
London Office: KERN HOUSE · 36 KINGSWAY, W·C·2 Tel: TEMple Bar 6666

FM 130/2



Have you A PRESSING PROBLEM?..

Accuracy, good finish, consistent high quality—these come naturally with Sutcliffe Speakman hot pressings and stampings. Machining can be undertaken to limits down to .0005″.
No quantity is too large, no job too complicated, no standard too exacting.

Pressings and stampings in non-ferrous alloys including aluminium, brass, chromium-copper, cadmium-copper, manganese bronze and nickel silver. Castings in gun-metal, phosphor bronze and heat-resisting nickel chrome alloys.

...ask **SUTCLIFFE SPEAKMAN**

SUTCLIFFE SPEAKMAN & CO. LTD., Leigh, Lancashire. Tel: Leigh 94. *London Office: 2 Caxton St., Westminster, S.W.1. Tel: Abbey 3085*

'ECONITE' PRE-FORMED INSULATING JACKETS

FOR **TANKS** and **CYLINDERS**

The HIGH EFFICIENCY LAGGING WHICH EFFECTS GREAT ECONOMY

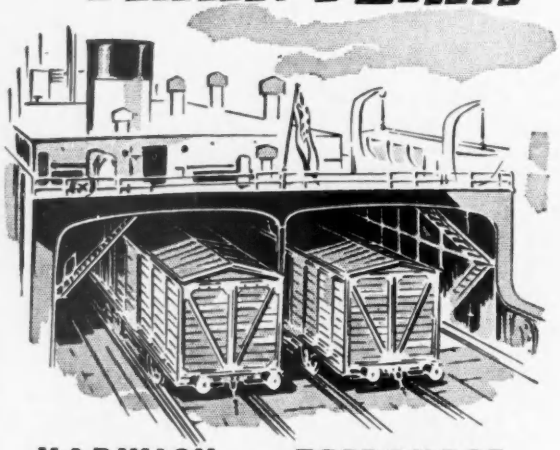
●

Available in Stout White or Brown Cotton Canvas Cream Glazed Plastic Cloth and Cream American Cloth

APPROVED BY THE C.E.G.B.
Manufactured only by
KITSON'S INSULATIONS LTD.
LONDON ROAD · BARKING · ESSEX. *Tel.: RIPPLEWAY 5544 (7 lines)*

Goods to European Markets in through wagons every day

BY **TRAIN FERRY**



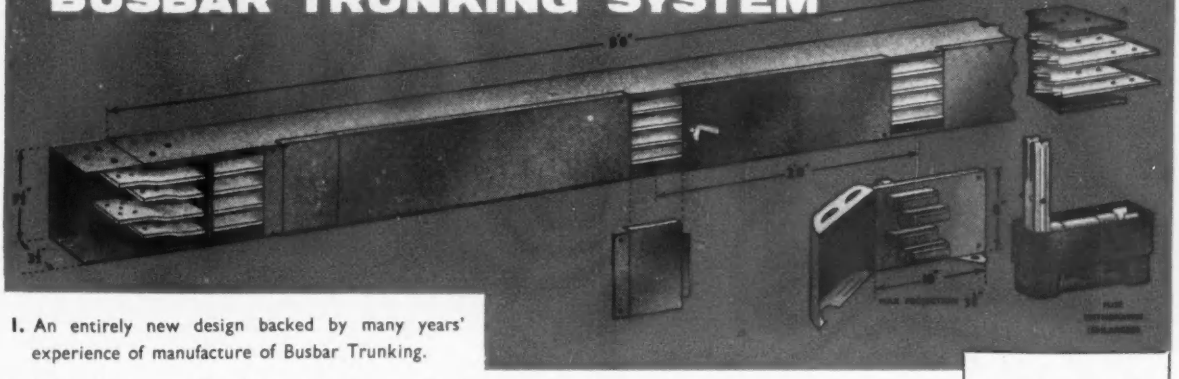
HARWICH - ZEEBRUGGE
DOVER - DUNKERQUE

Packing and handling absolute minimum

Full particulars from:—Continental Superintendent, Victoria Station, London, S.W.1 for Dover route and Continental Traffic & Shipping Manager, Harwich House, 129 Bishopsgate, London E.C.2 for Harwich route.

BRITISH RAILWAYS

Astralecon ... THE NEW ALUMINIUM-BUSBAR TRUNKING SYSTEM



1. An entirely new design backed by many years' experience of manufacture of Busbar Trunking.
2. Lightweight, over 25% lighter than conventional equipment without loss of strength (8¼ lbs./ft. run).
3. Of minimum size yet complying with B.S.S. standards for clearance and temperature rise.
4. Exceptionally attractive appearance.
5. Fuses and Neutral Link plug direct on to Busbar.
6. Side access for ease of installation and maintenance.
7. Generous cabling facilities to Tap Off Box.
8. Reduced headroom requirements.
9. Packing and C.I.F. charges slashed.

The ASTRALECON Busbar Trunking System, exclusively manufactured by Astral Switchgear Ltd., is designed to meet the demands of discriminating Engineers, Contractors and Users.

May we send you a copy of Publication No. 68.

WINS ON PRICE TOO

400 AMP TPN

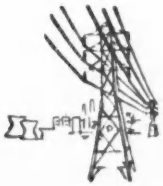
for as little as

£1.6.9. net

per foot run.

Delivery ex-stock.

ASTRAL SWITCHGEAR LIMITED ASTRAL **ENFIELD, MIDDLESEX. TELEPHONE HOWARD 2033**



Drawn in our own mill on a completely modern plant. Copper and Aluminium for cables, transformers, motors and the electrical trade generally. Copper Strand and Aluminium Conductors for Overhead Transmission Lines.

SPENCER wire

Spencers—manufacturers of wire for over 50 years

THE SPENCER WIRE COMPANY LIMITED • WAKEFIELD

Telephone • WAKEFIELD 6111 (10 lines) • Telegrams • SPENCER WAKEFIELD TELEX

Telex No. 55,160

DaW25860ET

A LOW VISCOSITY SOLVENTLESS VARNISH

DEVELOPED BY STERLING

The Sterling range of insulating varnishes is now augmented by COLDFLO—the solventless, cold flowing varnish which gives perfect penetration without pre-heating. Already established in the field. We shall be pleased to submit samples on request.

- *Thermal setting (stoved at 120°C).*
- *Cold flowing—perfect penetration without heating.*
- *Minimum cavitation.*
- *Excellent flexibility and heat ageing.*
- *Low moisture absorption*
- *Low power factor.*
- *Good storage life.*
- *Suitable for hot dip or vacuum impregnation.*
- *For transformers, chokes, field coils, capacitors, etc.*

MADE BY CHEMISTS
Sterling
INSULATING VARNISHES
SERVICED BY ENGINEERS

STERLING VARNISH CO. LTD.

FRASER ROAD, TRAFFORD PARK, MANCHESTER 17

Telephone : TRAfford Park 0282 (4 lines). Telegrams : "DIELECTRIC MANCHESTER"

London Office & Warehouse : 6 London Road, Brentford, Middlesex. Telephone : Ealing 9152.

ST 29

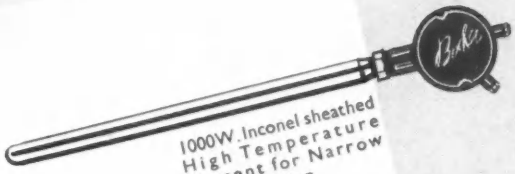
Another Backer Service

TUBULAR SHEATHED HEATING ELEMENTS

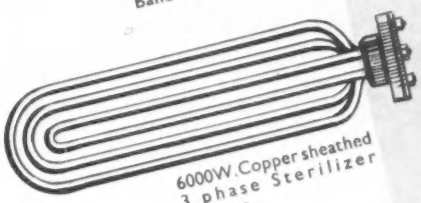
Quickly designed and tailor made expressly for you

in

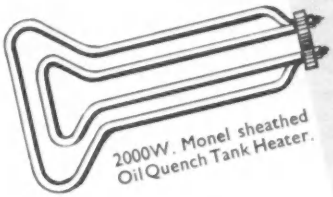
INCONEL, INCOLOY, MILD STEEL, STAINLESS STEEL, MONEL, COPPER, ALUMINIUM BRASS, ALUMINIUM BRONZE & NICKEL.



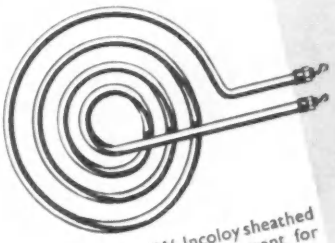
1000W. Inconel sheathed High Temperature Element for Narrow Band Radiation.



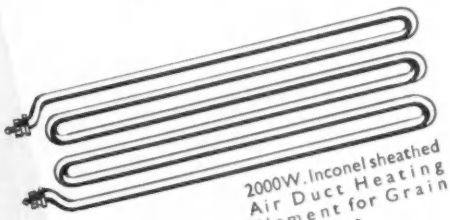
6000W. Copper sheathed 3 phase Sterilizer Element.



2000W. Monel sheathed Oil Quench Tank Heater.



2000W. Incoloy sheathed Forced Air Element for Greenhouse heating.



2000W. Inconel sheathed Air Duct Heating Element for Grain Drying Plant.

Backer

BACKER ELECTRIC COMPANY LIMITED
ROTHERHAM **YORKS.**

Telephone: Rotherham 78181 (8 lines) Telex: 54161

There's a bit of

BRAY

in almost everything

GAS JETS AND BURNERS

turn gas into heat in industry and in the home with economy and efficiency.

SPRAY JETS

for the accurate distribution of chemicals, oils and other fluids in industry and in agriculture.

ELECTRIC HEATING ELEMENTS

in strip, ring, tubular and cartridge form for manufacturing processes and finished products.

ELECTRO-CERAMIC INSULATORS

mass-produced to close dimensional tolerances for domestic appliances, industrial processes and the whole field of electronics.

LIGHT PRECISION ENGINEERING

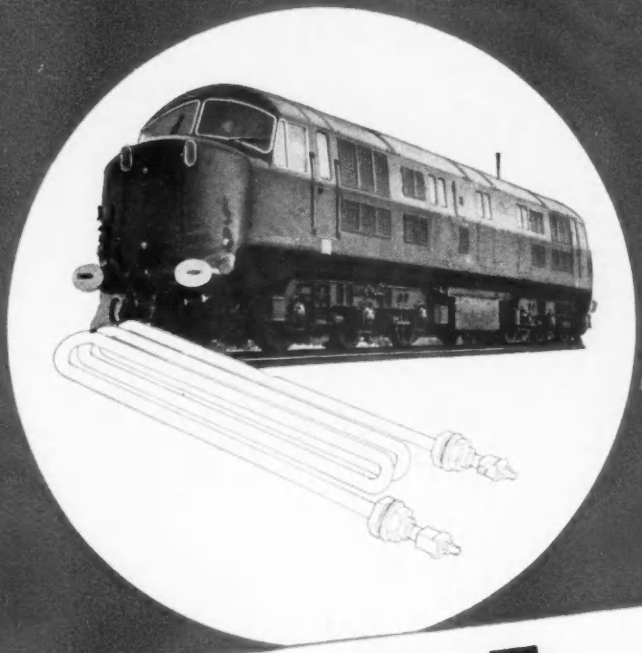
for every kind of intricate component, massed-produced to fine limits.

GEO. BRAY & CO. LTD., LEICESTER PLACE, LEEDS, 2. TELEPHONE: LEEDS 35399 TELEX: 55186

No. 9 OF A SERIES

—to keep engine drivers warm

NORTH BRITISH LOCO CO. LTD

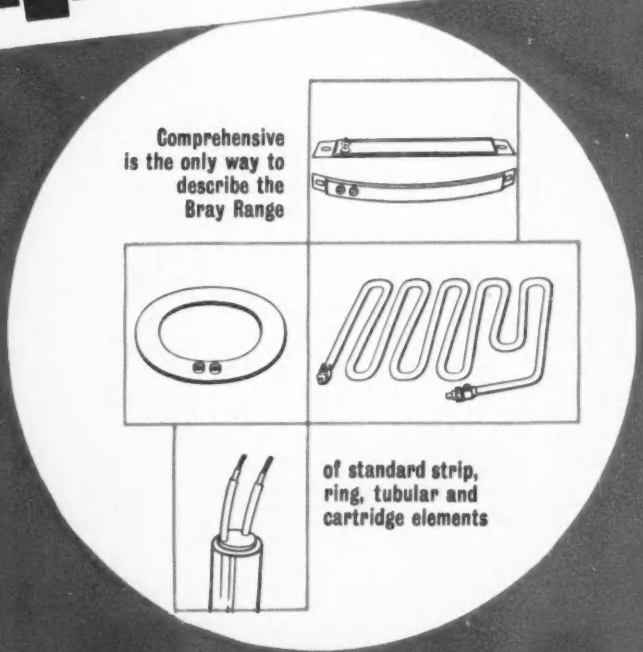


use BRAY Cab Heaters in their Diesel Hydraulic Locomotives

They brought in BRAY at the drawing-board stage

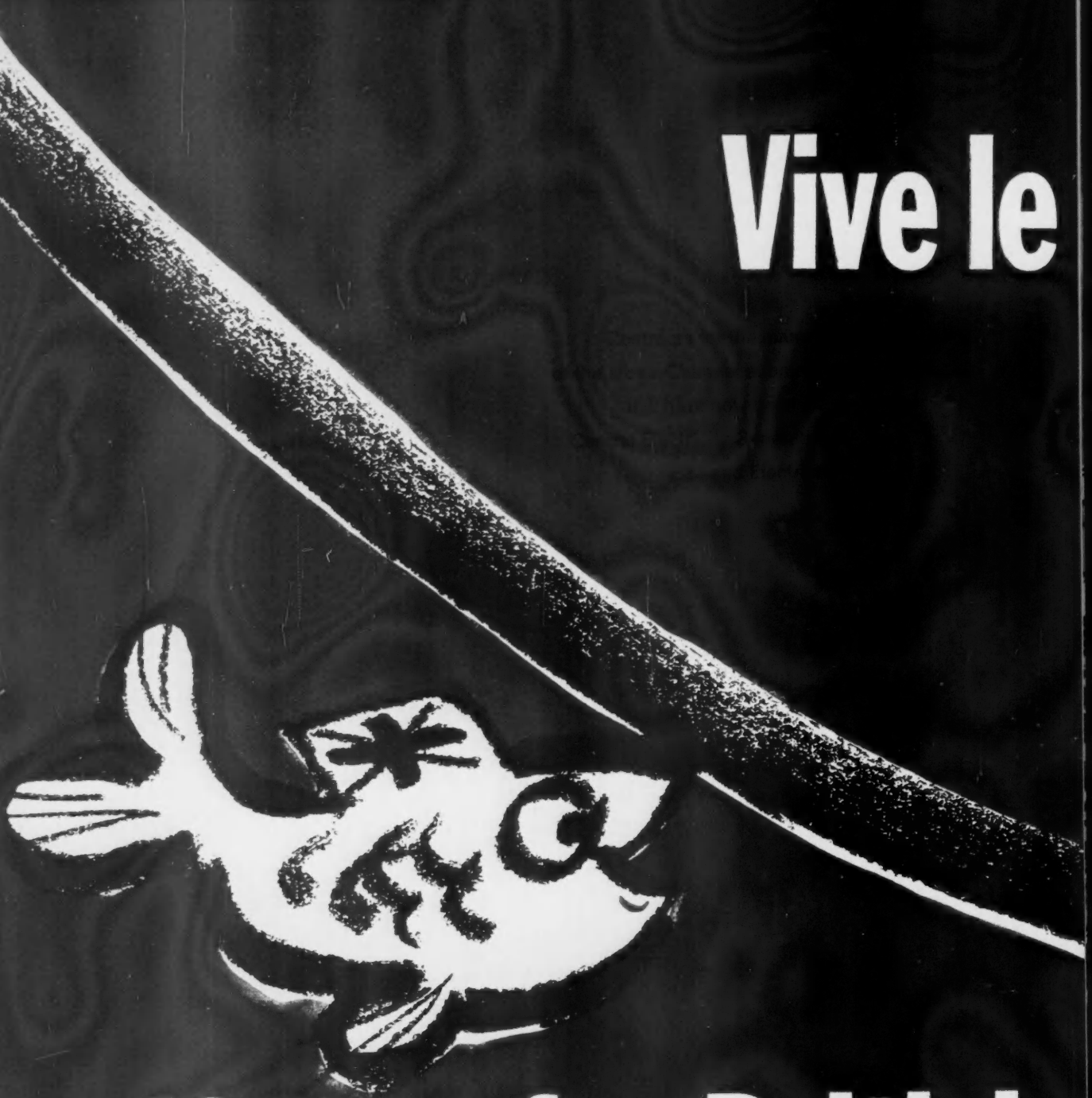
BRAY

ELECTRIC HEATING ELEMENTS



GEO. BRAY & CO. LTD., LEICESTER PLACE, LEEDS 2. Tel: LEEDS 35399. Telex: 55186

Vive le



'Ooray for British

AEI

new Power Alliance!

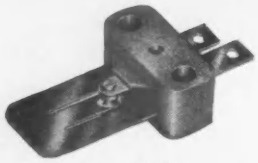
Cable!

CABLE DIVISION

Associated Electrical Industries Limited

51-53 Hatton Garden, London EC1. *Phone: CHAncery 6822*

SAFETY is OTTER'S business



Otter "PUP" Safety Cut-Out

for SAFETY'S sake fit

Otter REGD.

THERMOSTATS AND SAFETY CUT-OUTS

The simplest and safest of all

WORLD PATENTS INCLUDING PATENT NUMBERS 600055, 622781 624905, 657434, 713443, 749716, 774911, 782668 AND OTHERS. ALSO OTHER PATENTS PENDING.

OTTER CONTROLS LIMITED

OTTERS POLE, BUXTON, DERBYSHIRE

Phone Buxton 650 (2 lines)

O/1C.

ENJOY YOUR C-TA

KNOWING THIS SWITCH HAS BEEN LIFE TESTED TO **19 MILLION** OPERATIONS

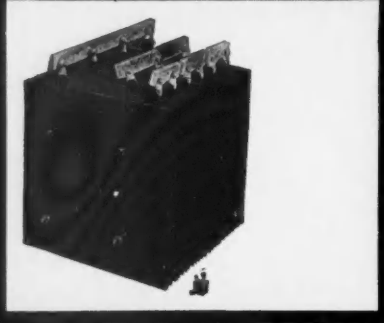
When it MUST be RELIABLE and you need something more ROBUST than a micro-switch—this MINIATURE HEAVY DUTY LIMIT SWITCH may be what you're looking for

- CHANGE-OVER CONTACTS
- QUICK MAKE AND BREAK
- RATING 2 Amps 250v, 1 Amp 500v } A.C. Inductive
- MEASURES 3¼"x2¼"x1¼" only

37/6 *Subject to usual discounts*

CONTACTOR SWITCHGEAR LTD., BLAKENHALL WOLVERHAMPTON Tel: 25911

AUTOMAT



High-Stability **RECTIFIERS**

MINING
RADIO & TELEVISION
BATTERY CHARGING
MAGNETIC AMPLIFIERS
PRINTED CIRCUITS

- *High Efficiency*
- *Non-Ageing*
- *Stable Output Voltage*
- *High Current Ratio*
- *Low Heat Losses*
- *48Hrs Prototype Service*

AUTOMAT MOORSIDE RD SWINTON MANCHESTER

Tel: Swinton 4242-3-4

ANOTHER BEST SELLER

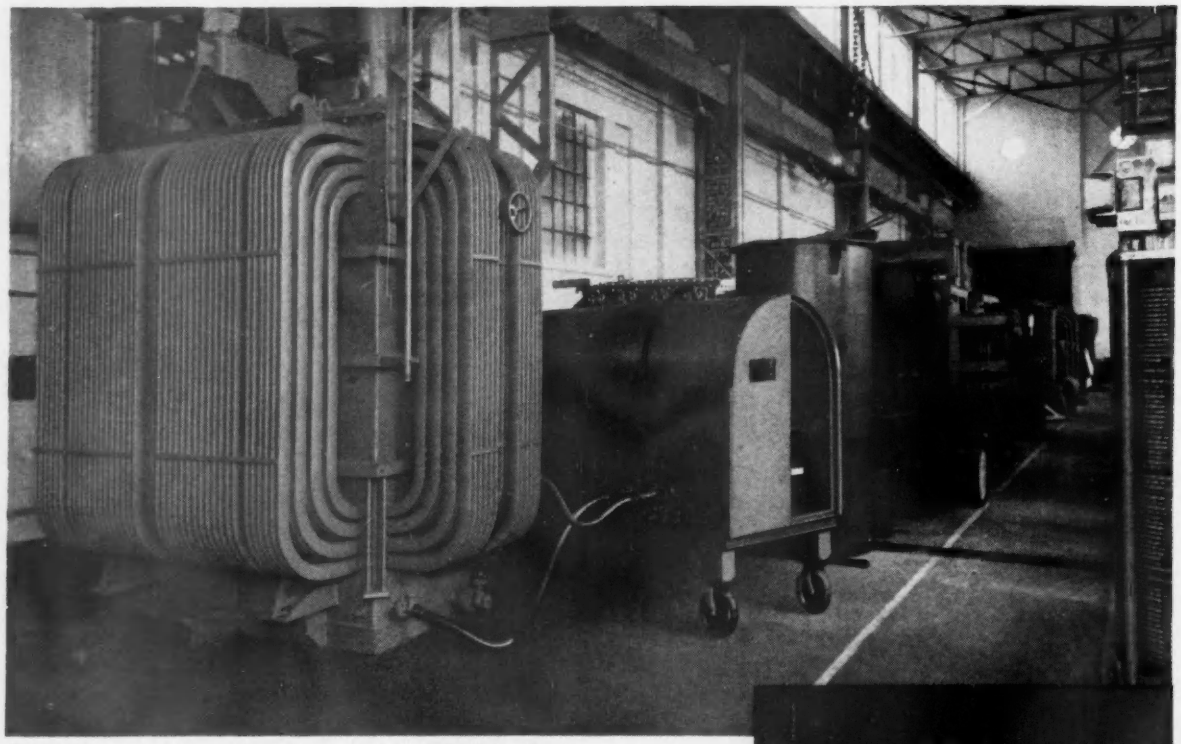
Strong and robust in construction, light in weight and easily portable, the elegant lines of the "Curtsey" make it part of any furnishing scheme. The fixed reflector is heavily plated and the safety guard efficient and pleasing in appearance. List Price—**1kw £2.2.6 2kw £3.1.6.**

Price including Purchase Tax **£2.10.3** and **£3.12.9**

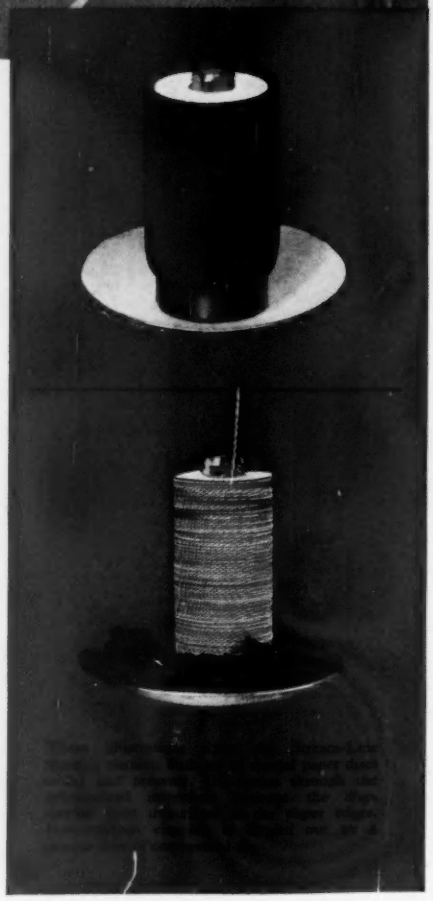
CARRON

CARRON COMPANY · CARRON · FALKIRK · STIRLINGSHIRE

Showrooms and Sub-Offices: 15 Upper Thames Street, London, E.C.4. 22-26 Redcross Street, Liverpool, 1
125 Buchanan Street, Glasgow, C.1. Sub-Office: 33 Bath Lane, Newcastle upon Tyne.



Photograph by courtesy of Bryce Electric Construction Co. Ltd., Hackbridge, Surrey.



A GOOD START IN LIFE

for insulating oil

STREAM-LINE FILTERS ENSURE SECURITY IN THE OPERATION OF CIRCUIT BREAKERS & TRANSFORMERS

New transformers and circuit-breakers need careful cleaning and drying, and must be filled with clean, dry oil. That is why so many manufacturers have installed Stream-Line filters in their works for filling transformers before they are tested and despatched.

It is also advantageous to filter insulating oil when transformers and circuit-breakers arrive on site, for at this stage no amount of care can be excessive. Subsequent periodic maintenance of the oil is also essential to security of insulation. Outstandingly important when considering security and maintenance is the fact that passage through a Stream-Line filter ensures the elimination of *all* solid impurities including the finest colloidal carbon and, in addition, the removal of all free and dissolved gases. The dielectric strength of the filtered oil is far greater than that specified for the highest quality new oil.

There is a Stream-Line filter installation or mobile unit to suit every requirement—please write for further details.

HIGH VACUUM

The standard Stream-Line filters working at moderate vacuum are fully adequate for most requirements but in order to cater for exceptional cases models are also available to operate under high vacuum. Treatment under conditions approaching absolute vacuum, combined with the unique Stream-Line edge-filtration principle, gives results with regard to the elimination of the last traces of air and moisture which are quite remarkable. Send us particulars of *your* special requirements.

STREAM-LINE

STREAM-LINE FILTERS LIMITED

HENLEY PARK, NORMANDY, NR. GUILDFORD, SURREY

Telephone: Normandy 3311-3. Telegrams: Edgefilt, Guildford.

A member of the VOKES Group with world-wide representation.

SF184

Osram go on TV !

Launch of new **extra light lamp**

'A bit of all light!'

Begins 19th Sept. on all ITV Stations for 6 weeks!

Watch for further announcements

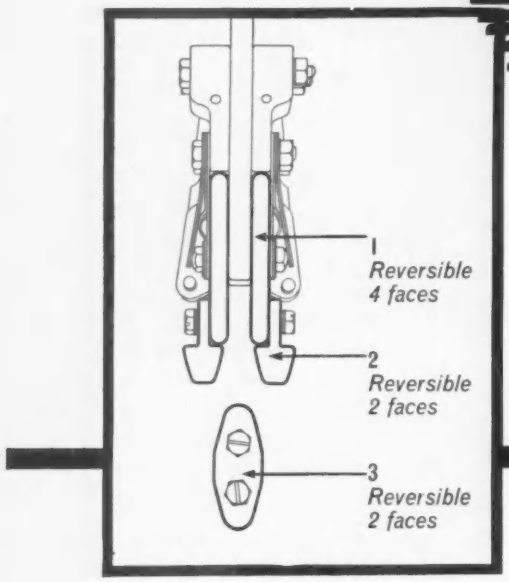
OSRAM LAMP DIVISION G.E.C

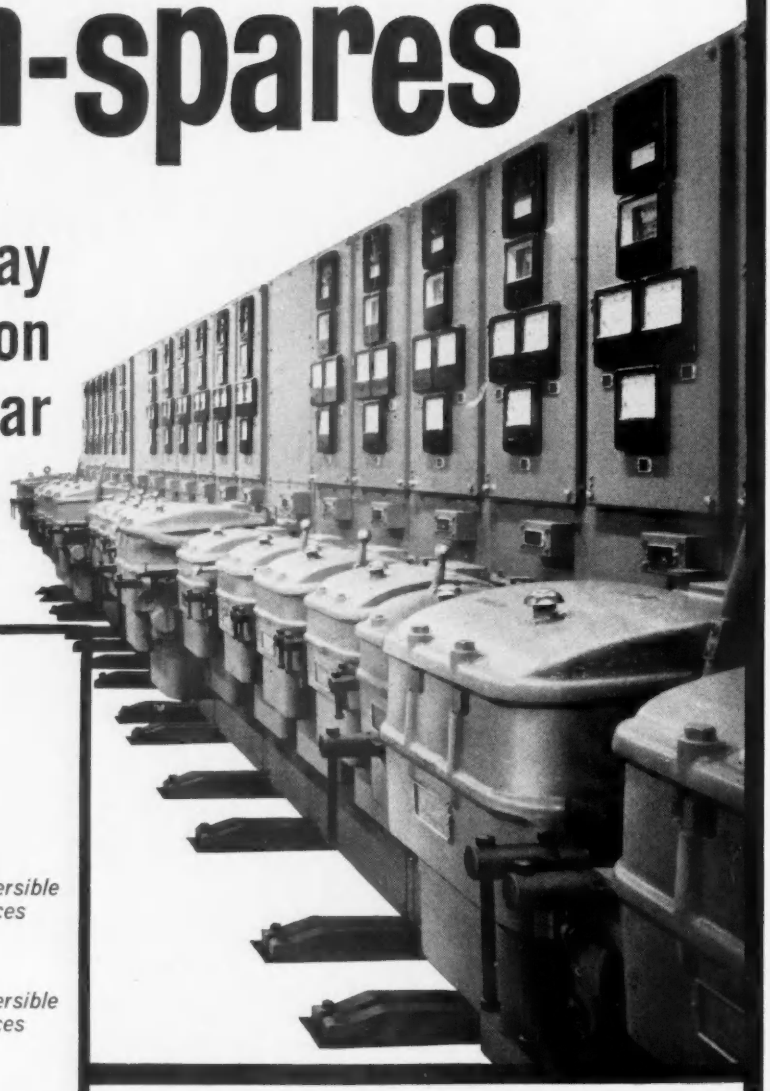
EMERGENCY MAINTENANCE!

Built-in-spares

eliminate delay with Ellison GEO switchgear

ASTA CERTIFIED TO B.S.116:1952





TRADE MARK

GEORGE ELLISON
LIMITED

PERRY BARR · BIRMINGHAM 22B

Did you know that the Ellison GEO switchgear has *built-in-spares?*
All contacts on the 400, 600, 800 and 1200 amp size circuit breakers are interchangeable and reversible—the arc contacts in a matter of minutes.
This is but one of the easy maintenance features that characterise Ellison GEO switchgear. May we send you further information?

867

THURSDAY 25 AUGUST, 1960
Registered as a Newspaper Volume 138 No. 8

ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

Fast Excitation Systems—No. 2, E.E. Co. 267
by N. H. Shaw, A.M.I.E.E.

Sweden Orders 400 kV Shunt Reactors 272

Supply Year in N.Z. 274

"Phasing-out" e.h.v. Cables 275

US 40 kW Linear Accelerator 276

Deep Freeze for Computers 282

Small Power Reactors 282

BEPC Past and Future 283
by J. W. Simpson, O.B.E., F.C.I.S.

Dans ce numéro

Système d'Excitation à Action Rapide 267
La système d'excitation à action rapide, utilisé par "English Electric Co" pour la commande de turbo-alternateurs de grandes dimensions, est basé sur l'utilisation de dispositifs à amplificateurs magnétiques liés à une alimentation triphasée 400 Hz, dérivée d'un alternateur à aimant permanent. Parmi l'appareillage fourni avec l'alternateur se trouve un circuit destiné à limiter la puissance réactive. Il a pour effet d'augmenter l'excitation quand le courant de stator dépasse la limite établie, pour des raisons de stabilité, par rapport à la valeur du courant de rotor.

Connexion de Câbles à Haute Tension 275
On doit prendre certaines précautions en connectant des câbles à haute tension, pour la première fois, pour assurer une succession de phases correcte. Parmi les essais à présent utilisés certains incluent l'emploi soit de transformateurs de tension, soit d'indicateurs de haute tension. Ces indicateurs se composent d'une tige isolée incorporant un voltmètre électrostatique et une résistance de valuer élevée. Cet article souligne l'importance de ces essais lorsque l'on installe un nouveau câble parallèlement à un autre déjà en service.

Progrès dans le Domaine des Calculateurs Electroniques 282
La vitesse de fonctionnement des calculateurs électroniques, mis au point l'heure actuelle pour être utilisés commercialement, est limitée par les facteurs physiques fondamentaux de fonctionnement des semiconducteurs et par les possibilités présentes des circuits en ce qui concerne la vitesse finie de transmission des signaux électriques. On obtiendra peut être des vitesses plus grandes en utilisant les propriétés de surconduction de métaux immergés dans de l'hélium liquide. Aux très basses températures réalisables on peut rendre les conducteurs résistants à l'aide d'un champ magnétique.

In dieser Nummer

Schnellwirkende Erregersysteme 267
Zur Steuerung grosser Wechselstrom-Turbogeneratoren baut English Electric ein schnellwirkendes Erregersystem auf der Grundlage magnetischer Verstärkeranordnungen, deren Drehstromversorgung mit einer Frequenz von 400 Hz einem Dauermagnet-Wechselstromerzeuger entnommen wird. Zur Ausrüstung des Wechselstromerzeugers gehört eine zur Blindleistungsbegrenzung dienende Schaltung. Diese erhöht die Erregung falls der Ständerstrom den Grenzwert übersteigt, der aus Stabilitätserwägungen mit Bezug auf den Läuferstrom vorgeschrieben wird.

Hochspannungskabelverbindungen 275
Beim erstmaligen Verbinden von Hochspannungskabeln müssen gewisse Vorkehrungen zur Sicherstellung der richtigen Phasenfolge getroffen werden. Einige der zur Zeit angewandten Prüfarten verwenden entweder einen Spannungsumformer oder einen Hochspannungsanzeiger. Letzsterer besteht aus einem isolierten Stab mit eingebautem elektrostatischem Voltmesser und hochohmigem Widerstand. Die grosse Bedeutung eines derartigen Prüfens beim Verlegen eines mit einem bestehenden parallelgeschalteten Kabels wird hervorgehoben.

Fortschritte auf dem Gebiet der Rechengeräte ... 282
Bei den heute für den Handel gebauten elektronischen Rechengeräten sind der Betriebsgeschwindigkeit natürliche Grenzen gesetzt, erstens durch die grundlegenden physikalischen Gegebenheiten des Halbleiterbetriebes und zweitens durch die endliche mit den heutigen schaltungstechnischen Mitteln erreichbare Geschwindigkeit elektrischer Signal-übertragung. Noch höhere Geschwindigkeiten dürften durch Ausnutzung der Supraleitfähigkeit in flüssiges Helium getauchter Metallkörper erzielbar werden. Bei den hierbei herrschenden äusserst tiefen Temperaturen können Leiter vor dem gänzlichen Verlust ihres inneren Widerstandes durch Magnetfelder bewahrt werden.

FEATURES

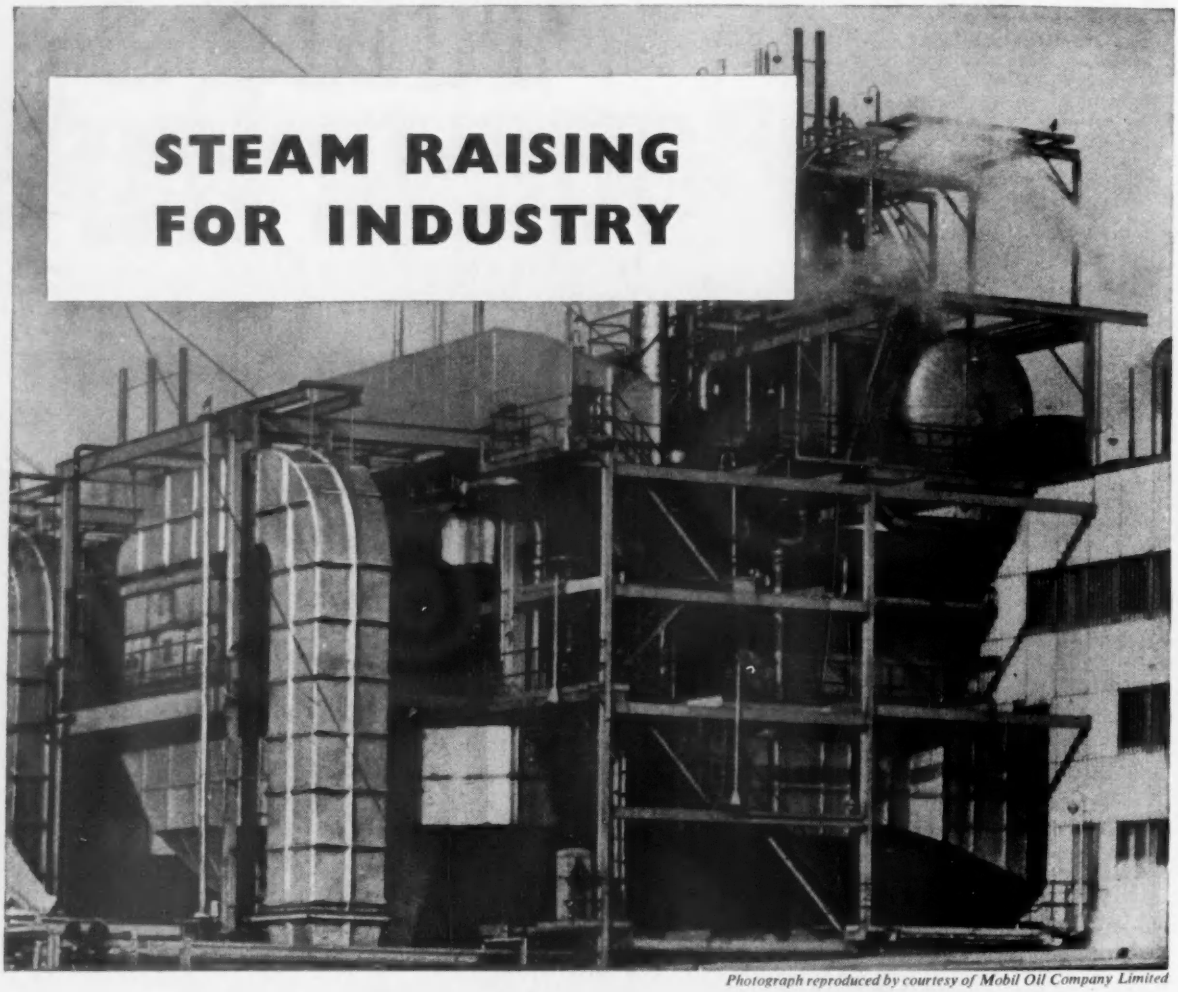
Readers' Views 273
Notes on Wiring *by Megohm* 277
Overseas News 278
Personalities in the Industry 280
New Literature 281
For the Electrical Trade 284
Equipment for Industry 285
Problems and Practice 287
Power Supply Statistics for July 288
News of the Week 289
Company Activities 294
Commercial Information 295

News Sheet 17
Classified Advertisements 41
Index to Advertisers 50

© The Electrical Times Ltd., 1960

SUBSCRIPTION RATES: United Kingdom £4, Overseas £4 10s per annum. Canada and USA $12 per annum. Subscriptions are payable in advance and may commence with any issue. Overseas subscriptions may be paid by banker's draft, cheque, international money order or credited to the Electrical Times Ltd., at Coutts and Co., 440 Strand, London WC2. Single copies price 1s 6d. Postage 6d.

STEAM RAISING FOR INDUSTRY



Photograph reproduced by courtesy of Mobil Oil Company Limited

MOBIL OIL COMPANY LIMITED, CORYTON REFINERY

3 boiler unit each producing 180,000 lbs/hr. at 615 p.s.i. 750°F.

International Combustion build boilers to suit the individual steam raising requirements of every industry. Whatever the problem, IC steam generating equipment ensures the best use of fuel resources.

WATERTUBE BOILERS FOR OIL, GAS OR SOLID FUEL FIRING

INTERNATIONAL COMBUSTION LIMITED

LONDON OFFICE: NINETEEN WOBURN PLACE · WC1 · TELEPHONE: TERMINUS 2833 · WORKS: DERBY

Member of Atomic Power Constructions Ltd. One of the British Nuclear Energy Groups

IB 14

ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 25 AUGUST, 1960

Editor and Managing Director:
ROY BALDWIN, M.I.E.E., Barrister-at-Law

Joint Editor:
K. C. POUNDS, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

News Editor:
T. W. WRIGHT

Comment

FIXED PRICE MARGINS

3d/hr for journeymen electricians is the effective wage increase that results from the two-hour cut in the electrical contracting working week now agreed between employers and union. Some of this increase could be offset through implementation of a clause in the new agreement pledging both sides of the industry to avoid time wasting and seek close observation of starting and stopping times; but even if that receives full attention at site level, the labour cost in contracts is likely to increase. To a greater degree than with other increases in recent years, it is the contractor who will have to bear this cost. This follows from the accelerated trend to fixed price contracts, without labour and materials-cost clauses. Pressure for this type of contract arose from a Government committee report in 1957, but the safeguards then recommended for the contractor are not always respected. In return for a fixed price for the job, the customer was to give quick adjudication of tenders, and limit the run of a contract to two years. In practice, this arrangement has worked less favourably for the electrical contractor than for structural firms. The electrical contractor may find that his work is concentrated in the last few months of the two-year period, and he is particularly vulnerable to delays in building progress, such as have been occasioned recently by the shortage of bricks. Cautious contractors have provided for such contingencies by an appropriate increase in their tenders, but how much insurance can be written into a contract in this way is sharply limited in a highly competitive industry. The new wage increases should impress more widely the need to relate some such contingency addition to estimated costs to duration of contract.

ELECTRIC HEATING IN AMERICA

American supply authorities have traditionally turned their faces against electric heating. Now they are thinking again and, typically, they are thinking big. A speaker at the recent annual conference of the Edison Electric Institute, the association of private enterprise supply companies, dealt with electric house heating as "the big market of the sixties," though the statistics he quoted showed that this is an evaluation of prospects rather than achievement-based probability. At present only just over 1% of US domestic consumers are substantial users of electric heating, a proportion that looks forlorn against the 14% saturation that has been built up in air conditioning. This rise in air conditioning, essentially a summer load of course, has played a major part in persuading supply authorities that they must encourage electric house heating, but other factors are at work as well. Drive

is provided by their belief that the all-electric house concept has an attraction that is a powerful sales urge in its own right. American companies' approach to electric heating is coloured by this concept. There is more accent on built-in heating than in this country, notably through baseboard units or ceiling heating, but floor-warming seems to get relatively little show. The all-electric idea is also behind the accent placed by the Edison Institute speaker on the need to win the favourable attention of the US equivalents of building societies and estate agents. Although practice in this field will not be translated directly from America to Britain, the techniques adopted on the other side of the Atlantic will be worth thinking about in respect of their underlying principles; for the electrical industry here has still to tackle whole-heartedly the problem of how best to sell electric heating for the home.

FOOTBALL MARKET

The summer-like beginning to another Association Football season faces the supply industry with an important sales problem. Will it succeed in getting across the idea that soil-warming for pitches as a precaution against frost and subsequent mud-baths is worth while? Last year was disappointing in this respect, after the notable success of the Everton installation in the previous season; and the abandonment of the electrical installation there, albeit for reasons unconnected with the heating technique, was an unquestioned setback. On the other hand, the basic idea of pitch heating has been demonstrated as practicable, and the methods now available for laying the heating cables without serious interference with the playing surface make the decision to go to pitch heating less drastic in its implications than was once the case. What is lacking now is the capital on the part of the football clubs, if reports of their financial difficulties be correct; and perhaps the spur of cancelled games that would be provided by a winter more inclement than was that of 1959-60. Once the capital cost has been faced—and at somewhere around £6,000 it is sizeable but hardly of prohibitive magnitude compared with many transfer fees—then the running cost of the anti-frost operation compares favourably with alternative methods, offers far better prospects of being effective, and provides a bonus by way of consistently better playing conditions. It is perhaps too much to hope that the same success can be achieved with pitch heating as has been secured by the now general floodlighting, but a renewed drive for such business is likely to figure in commercial departments' current plans.

COMPUTER COMPACTNESS

In electronic computer engineering, it is a significant factor that light and other electromagnetic radiations travel about 1 ft in one thousand-millionth of a second. It is largely this consideration, and the consequences that flow from it, which are making physical dimensions a limit to further increase in the working speed and memory capacity of these devices. Not the only limit, though. So high are the rates of operation now used that the physical basis of change of state in the bistable devices used for the binary arithmetic of digital computers has to be considered time-wise. It involves time lags that are significant on the fantastically compressed time scale within which computer designers work. In a long-term attempt to defeat such difficulties, computer firms are now thinking of making practical use of the exotic world of scientific oddities which have long been known but which seemed unlikely to have much direct engineering application. Notable is the practical application of superconductivity at liquid helium temperatures, as a step in the speeding up of state changes. More sensationally, and philosophically more tempting, is the idea of engraving of thin single domains of iron, to take miniaturisation to the stage where the information-packing density of the human brain is at least approached. It is entirely in keeping with the spirit of this advanced-thinking field that such an engraving technique should be envisaged as carried out automatically, controlled by an electron microscope.

POWER IN THE NEW AFRICA

Last week's successful conclusion to the lengthy negotiations to find finance for Ghana's Volta River hydro-electric scheme adds to the impressive list of major electrical works in hand in the developing countries of the African continent. Unlike most of its predecessors, the Volta River scheme is tied industrially to a single industry, aluminium smelting, and most of the 768 MW installed capacity is earmarked for that purpose. But the 50 MW or so allocated for general distribution will be a sizeable contribution to meeting the general demand in Ghana, and a subsidiary power project will be made possible if the main scheme is carried through—something that still seems dependent on successful conclusion of an agreement with a major aluminium concern. Farther along the coast, the Nigerian Federation has a major hydro scheme under consideration, by way of development of the Niger and Kaduna Rivers, which together could give an electrical output of 1,300 MW at a capital cost of about £94/kW. Unlike the Ghana scheme, this is tied to general electrical growth rather than any single industry and there are considerable water control advantages to be obtained from building the dams required, a facet of hydro schemes of relatively little significance in the Volta project. Just how the Nigerian scheme might be financed has not been worked out in detail, but external capital would clearly be necessary and it might well come from a combination of Commonwealth and World Bank sources, which, in the Volta scheme, are supplemented by direct US Government lending. Past experience shows that the financing method will have much influence on who receives the valuable plant orders; and that if the World Bank is heavily involved, international tenders will be called for.

Meteor

This week's quick summary of electrical news faces advertisement page 16

Fast excitation systems

LARGE GENERATOR SCHEMES—No. 2, E.E.Co.

by N. H. Shaw,* A.M.I.E.E.

MODERN fast-acting voltage regulators, working in closed-loop control with static electrical control elements, are now well established. The first prototype regulator made by the English Electric Company was in operation in 1953 on a hydro set, and since then many regulators have been commissioned on both hydro and steam installations.

For turbo-alternators English Electric offer two types of regulator:

(1) MAEX—Fully monitored with selector switches and instruments to facilitate checking the circuit while in operation.

(2) SAEX—A simplified version of the MAEX without monitoring.

The simplified circuit diagram for both these types is given in Fig. 1. No separate m.g. set is required, all the machines shown being driven by the turbine. Further details of the control scheme are as follows:

High Frequency Alternator (HFA). This is a permanent-magnet three-phase 400 c/s alternator which provides a reliable power supply to all magnetic amplifiers and other circuits such as the references for manual and automatic control.

Manual Control Reference. This is a three-phase transformer-rectifier unit energised by the HFA, supplying power to the manual control potentiometer which is the manual reference.

Automatic Control Reference. This is a saturating magnetic device, supplied from the HFA. Fig. 2(a) shows the circuit for the magnetic reference. The circuit is simplified in that for the load we have a single-phase full-wave bridge to convert to direct current and this is then filtered to remove the ripple (a.c.) components of current. The final output is a constant direct current which appears to come from a high-impedance source because the value of the current is determined by the reactor "C" and not by the load impedance.

The equivalent circuit is shown in Fig. 2(b) where V_L is the voltage impressed across reactor C and load.

The shunt-connected reactance X represents the magnetising reactance of the saturating transformer A. Reactance X changes from the unsaturated value to the saturated value during one half cycle of the input voltage with the result that the voltage V_L is non-sinusoidal. The effects of saturation are best considered by open-circuiting the load; Fig. 2 (c) shows this condition.

The period of unsaturated operation is shown in Fig. 2(c) between the angle 0 and θ. X in the equivalent circuit is very high and can be neglected. Therefore output volts equal input volts. When saturation occurs, X drops to a low value which would still cause a voltage to appear across the load if the mutual coupling of transformer B

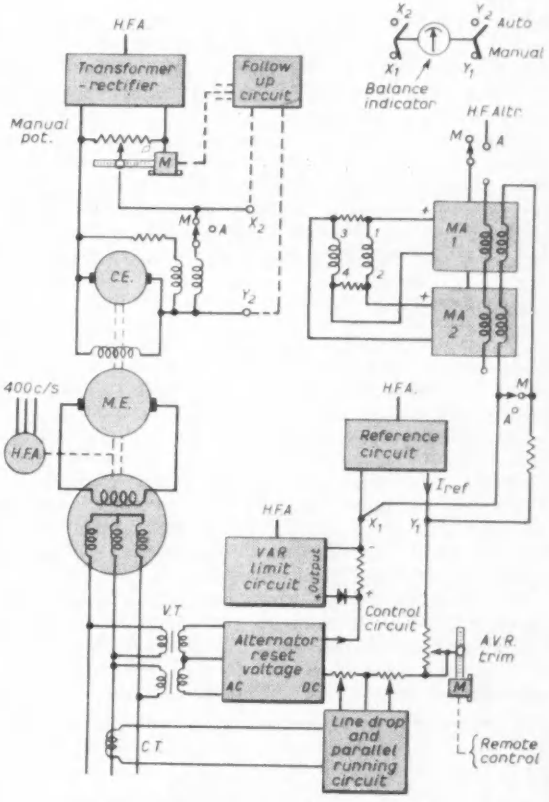


Fig. 1. Simplified diagram of English Electric automatic voltage regulators for turbo-alternators

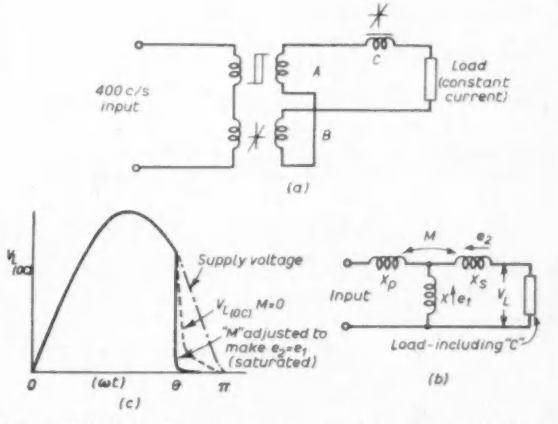


Fig. 2. Operation of saturating magnetic device as automatic control reference. (a) Simplified circuit, with A, a saturating transformer; B, a transformer with air gap; C, a reactor with air gap. (b) Equivalent circuit. (c) Wave form for open-circuited load

* Mr Shaw is with the English Electric Co. The article is based on a lecture in a series on fast excitation systems for modern turbo-alternators, held at the Borough Polytechnic. (Organising lecturer, Mr L. F. Spence.)

were ignored. The effect of the mutual coupling can be made to make $V_{L(oc)}$ zero during the saturated period between angles θ and π as shown.

For constant frequency, the area under the output voltage curve against time, over a full half period, would then be constant irrespective of possible variations of input voltage because this volt-time area is a function of the total flux change in the saturating transformer, i.e., twice the saturated value.

The output voltage, as described above can be taken to be independent of small input voltage variations but is still frequency-sensitive. If we make the load inductive (reactor C) the resulting current would be relatively constant both for voltage and frequency variations, with typical performance, $\pm 0{\cdot}5\%$ accuracy for $\pm 10\%$ voltage or voltage and frequency variations. With the power supply for the reference coming from the HFA, voltage and frequency variations will be much smaller than the above.

Temperature changes will affect the reference current due to a reduction of the flux saturation level with increased temperature. Normally small effects such as this can be accepted since they do not occur quickly.

Control Circuit

The alternator voltage is stepped down and rectified by a three-phase silicon rectifier bridge, which is connected in series with the control circuit carrying the reference current I_{ref}. (See Fig. 1.)

The potential between the points X_1 Y_1, is in fact the control "error" signal fed to the magnetic amplifier unit. Normally this potential is almost zero. Obviously, to obtain this condition, the volt drop produced by the reference current in flowing round the control circuit must be equal and opposite to the injected voltages—mainly the alternator reset voltage.

The reference current, which remains unchanged, can therefore produce a reference voltage proportional to the value of circuit resistance. The method of trimming the automatic control is therefore to alter the circuit resistance as shown, by the motorised rheostat. Any

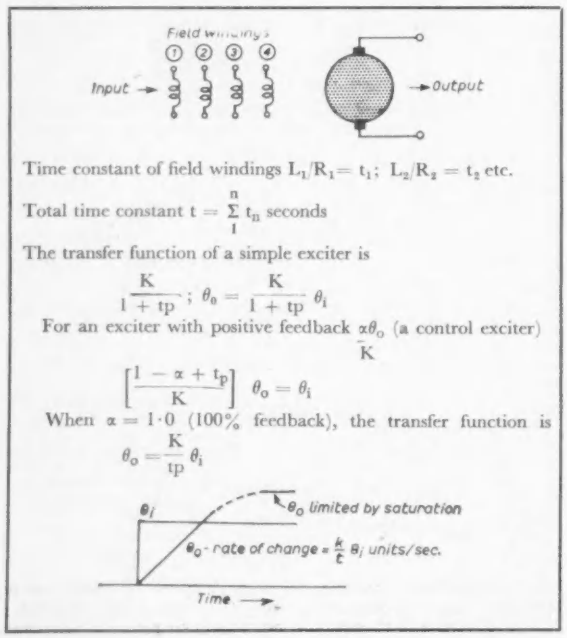

Field windings
1 2 3 4
Input
Output
Time constant of field windings $L_1/R_1 = t_1$; $L_2/R_2 = t_2$ etc.
Total time constant $t = \sum_{1}^{n} t_n$ seconds
The transfer function of a simple exciter is
$\frac{K}{1 + tp}$; $\theta_o = \frac{K}{1 + tp}\theta_i$
For an exciter with positive feedback $\frac{\alpha\theta_o}{K}$ (a control exciter)
$\left[\frac{1 - \alpha + t_p}{K}\right]\theta_o = \theta_i$
When $\alpha = 1{\cdot}0$ (100% feedback), the transfer function is
$\theta_o = \frac{K}{tp}\theta_i$
θ_i
θ_o limited by saturation
θ_o - rate of change = $\frac{k}{t}\theta_i$ units/sec.
Time

Fig. 3. Application of positive feedback to increase gain of simple exciter

transient change in alternator volts will appear at X_1 Y_1 as a positive or negative error to correct the excitation of the alternator through the magnetic amplifier-exciter chain.

Magnetic Amplifier. The main magnetic amplifier, which receives the error signal from the control circuit and in turn excites the control exciter, is push-pull Class A operated. Due to the control exciter being self-excited (it is described later) the normal operating condition is near the balance point, i.e., net steady output near zero. During a transient therefore, the full forcing effort of the magnetic amplifier is available.

The outputs of MA1 and MA2 are connected to opposite corners of the bridge-connected load. In this way there is 100% utilisation of field space, compared with 50% for separate buck-boost fields. When MA1 is at full output and MA2 at minimum output, both control exciter field windings are similarly excited (i.e., 1 to 2 and 3 to 4) and contribute equally to exciting the control exciter. When the reverse is the case and MA2 is at full output, MA1 zero, then both windings are equally excited in the opposite sense.

Other features of the push-pull amplifier are:

(1) Bias supplied by self feedback.

(2) Gain adjustment also by negative feedback.

Control Exciter. Application of positive feedback or self-excitation converts a standard type exciter into one with much higher power amplification.

Fig. 3 shows how the simple exciter with self-excitation becomes an integrator with theoretically infinite steady state gain, i.e., steady state output can be maintained with zero input. In practice, three factors can cause departure from the ideal.

(1) Speed variation.

(2) Hysteresis effect in magnetic circuit.

(3) Temperature changes vary the value of self-excitation due to resistance changes in the field coils.

The latter effect can be eliminated by a special circuit. However, even with the shunt self-excitation shown on Fig. 1 the drift due to this is quite small.

Main Exciter. Response requirements often specified by customers dictate the design as far as ceiling voltage and field time constant are concerned. This practice, dating back to the older mechanical a.v.r's, is still applicable.

Alternator. When the alternator is on open circuit, the transfer function is a simple time lag. On load, the transfer function is more complicated, because of the magnetising effect of the stator current on the rotor. The effect is a function of rotor angle relative to the system, as well as varying with the value and power factor of the stator current.

A true analogue of the alternator to cover all conditions can be achieved only on a computer, this being due to the non-linear effects of changing rotor angle and power factor. An approximate representation permitting transient performance calculations can be made by linearising the transfer function, which then only holds for small changes in rotor angle about the mean value selected for analysis.

Closed Loop Control. In order to provide a reasonable damped response, stabilising circuits feed back to the control, rate of change signals from the control exciter, the main exciter and the alternator. These are adjusted when the regulator is being commissioned and should not require any further adjustment during service. Fortunately, it is only necessary to set these circuits for the open-circuit condition. Normal loading conditions never require more damping in the circuit.

Accuracy of Control. With the older electro-mechanical regulators, terms such as insensitivity, dead band or zone were applied, meaning the change in signal which may take place without initiating any control action. It is usually assumed that the modern quick-acting a.v.r. has virtually no dead zone. English Electric a.v.r's have been tested on open circuit with step changes in control as low as 0·1%, and it has been possible to record the response. Checking much smaller changes than this becomes more of a measuring problem, demanding accurate and sensitive instruments. The author is certain that if there is any insensitivity, it must be very much below 0·1% and is therefore of no practical significance.

An indication of the regulator sensitivity is given by the change in the error voltage required to swing the alternator excitation over the full working range. Such an error change would be from 0·25 to 0·50% of normal controlled voltage.

Long term drift effects are almost entirely due to temperature changes affecting the reference. These effects are small, and can be corrected as required by the operating staff.

Transient Response. The speed with which the alternator recovers from any change is dependent to varying extents on all component units of the complete closed loop system.

For small changes the major factors are:

(1) Time constants of alternator, main and control exciter fields.

(2) Closed loop gain.

Linear theory shows that the response for such small changes varies in amplitude only, with response time remaining the same.

Another factor becomes apparent when larger changes are made, and this is saturation in the main and control exciters, which limits their maximum output volts. The effect on the alternator response is to increase the time required to make the change.

A step change in control with the alternator on open circuit is a satisfactory way of demonstrating the response of the complete system. In Figs. 9 to 13, results of tests on a 125 MVA alternator are given. These results also include on-load testing with the VAR limit circuit in operation.

Additional Control Features

Parallel Operation. (PRC). The requirement for satisfactory parallel operation is controlled sharing of the wattless current. When there is a transformer between the alternator and the paralleling point (controlled alternator voltage) the transformer reactance will prevent any one alternator from accepting more than its share of the wattless kVA. However, even in such cases it is usual practice to supply an additional circuit to compound the alternator voltage control with wattless control. When the paralleling point is also the controlled point of the system, this wattless control circuit is essential, and the regulator is more a controller of wattless power than of voltage.

Established principles of wattless control still apply such as quadrature droop compensation and differential compensation. The standard English Electric circuit works similarly to the quadrature droop method differing only in the way of achieving the result.

The parallel running control signal injected into the control circuit as shown in Fig. 1, is a d.c. signal proportional to the wattless current supplied by the alternator.

Fig. 4 shows how the "in-phase" component of current is measured in a simplified single-phase circuit. To measure the wattless component it is necessary to use a voltage vector in phase with the wattless.

In the actual circuit, the c.t. is placed in any line and the phasing voltage is selected from the three-phase output to be in phase with the zero power factor current in the c.t. This voltage operates the switches (rectifier bridges) S1 and S2. It may be shown that the d.c. output current (current source) is a function of the current component in phase with the phasing voltage, i.e., in this case the output is proportional to the wattless component of current.

Line Drop Compensation (LDC). An identical circuit to the parallel running circuit is used for line drop compensation, the difference being as follows:

(1) The input must be proportional to the total station output current instead of the individual machine current.

(2) The output d.c. signal is injected into the control circuit in the opposite sense, since the object of LDC is mainly to counter the droop due to the PRC signal and also the reactance drop in the transformer.

Recording Stator Current Transients. The test results shown in this article include load tests with the VAR limit in operation. Such tests have to be recorded over several seconds, and consequently the chart speed is reduced to the point where a 50 c/s current trace would not record individual cycles. The alternative is to record the stator current as a d.c. transient and with the aid of such circuits as PRC and LDC, the stator current can be divided into watt and wattless components. Smoothing would be necessary of course to get rid of the unwanted a.c. components.

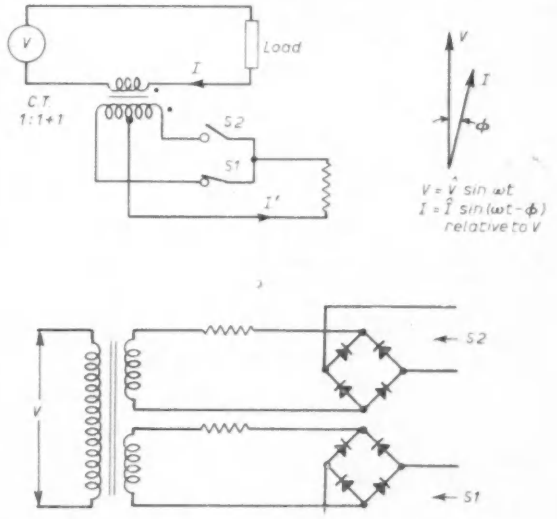


Fig. 4. Measurement of watt or wattless component of stator current (d.c. output)

I′ = I for S1 closed, S2 open
I′ = −I for S2 closed, S1 open

Condition of operation

S1 closed, S2 open on positive half cycle of V
S2 closed, S1 open on negative half cycle of V

D.C. component of I′ is average value taken over one cycle of voltage

$$I'_{av} = \frac{\omega}{2\pi}\left[\int_0^{t=(\pi/\omega)} I_{max} \sin(\omega t-\phi)\,dt + \int_{\pi/\omega}^{2\pi/\omega} -I_{max} \sin(\omega t-\phi)\,dt\right]$$

$$= \frac{I_{max}}{2\pi}\left[-\cos(\omega t-\phi)\Big|_{t=0}^{t=\pi/\omega} + \cos(\omega t-\phi)\Big|_{\pi/\omega}^{2\pi/\omega}\right]$$

$$= \frac{2}{\pi} I_{max} \cos\phi \text{ , d.c. component of } I'$$

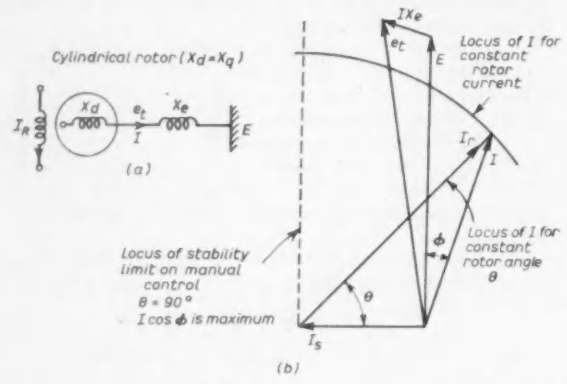


Fig. 5. Diagram showing relationship of stator current, rotor current and rotor angle

E = voltage of infinite bus (constant); e_t = alternator terminal voltage; I = alternator output current referred to E; I_R = rotor current; I_r = component of stator current due to I_R; I_s = component of stator current representing stator excitation, I_R zero; $I_s = -E/(X_d + X_e)$; φ = p.f. angle; θ = rotor displacement angle from no-load (relative to system)

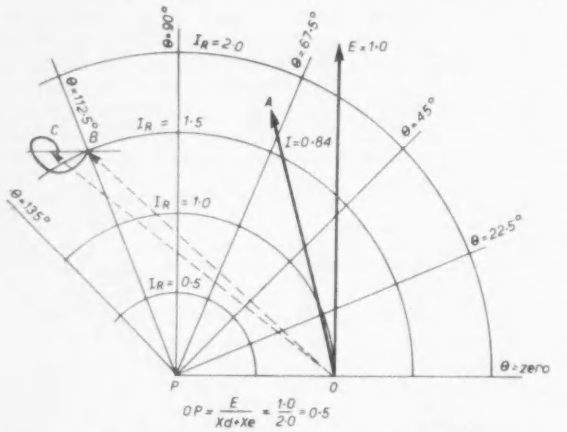


Fig. 6. Vector diagram of stator amps in per unit values, related to system volts. E = 1·0 units, $X_e + X_d = 2·0$ units. Loci of constant rotor amps and constant rotor angles are drawn to define the operating condition for any stator current, e.g. I = 0·84 units as drawn, corresponding θ = 70°, I_R = 1·7 units. Curve from B to C shows locus of stator current change

Manual Control. When electro-mechanical regulators were used, the main exciter was excited by a level-compound pilot exciter, the manual rheostat was a large and costly item, controlling the main exciter field by change of circuit resistance. The level compound pilot exciter, operating at fixed voltage has been replaced with the control exciter with variable voltage control, and taking advantage of this, the manual control has been moved to the control exciter field circuit. (See Fig. 1.)

For manual control, there is in fact a separate closed loop control on the control exciter, the output voltage of which will vary in sympathy with the setting of the manual control potentiometer which acts as the variable voltage reference. It should be noted that this control loop is closed only when manual control is selected.

An advantage obtained by this method of manual control is that the control potentiometer is now the same size as the automatic trimming control.

Manual or Automatic Control Selection. The change-over switch for manual or automatic control is shown in Fig. 1. In order to avoid a disturbance when a change-over is made, it is necessary to adjust the incoming control to the correct level for take-over. If the control system is working on auto-control, the manual control potentiometer has to be set to the correct value; this is done by operating the motorised control until the voltage between X_2 and Y_2 as measured by the balance indicator is zero. Similarly, when on manual control, the balance indicator is switched to measure volts at X_1 Y_1 and the a.v.r. trim rheostat is driven to make this zero.

The balance indicator is a moving-coil meter sensitive to small voltages, and whenever it reads zero the selector switch can be changed without disturbance to the alternator.

Manual Follow-up Circuit. When on automatic control, the manual closed loop on the control exciter is broken. If a change in load on the alternator occurs, the automatic control changes the control exciter volts to suit. This results in a voltage at X_2 Y_2 (Fig. 1) which is taken as a control signal for the follow-up circuit. This circuit consists of a pair of magnetic-amplifier-operated relays, and is polarity sensitive, so that the drive motor on the manual potentiometer is operated in the right direction to reduce the voltage X_2 Y_2 to zero.

There is naturally a delay in any adjustment due to the slow rate of travel of the motorised potentiometer (full travel approximately 45 secs.). When the potentiometer voltage is within a volt or so of the correct position the relay will drop out, and the motor stops.

VAR Limiter Circuit. To understand the need for this circuit and how it operates it is necessary to consider the alternator in more detail. Fig. 5(a) represents the alternator coupled to an infinite system through an equivalent reactance X_e. The vector relationship with respect to the system voltage E is shown in Fig. 5(b). The stator current I has been shown to have two components I_s and I_r.

Component I_s.—If rotor excitation I_R is made zero the system would see a reactance of $j(X_d + X_e)$. Current flow *out* of the alternator is therefore $I_s = -E/[j(X_d + X_e)]$ which leads E by 90°.

Component I_r.—This is the component of stator current produced

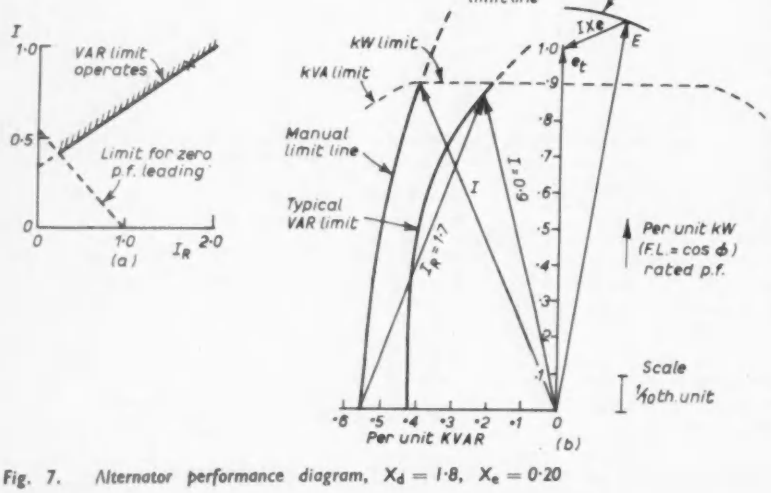


Fig. 7. Alternator performance diagram, $X_d = 1·8$, $X_e = 0·20$

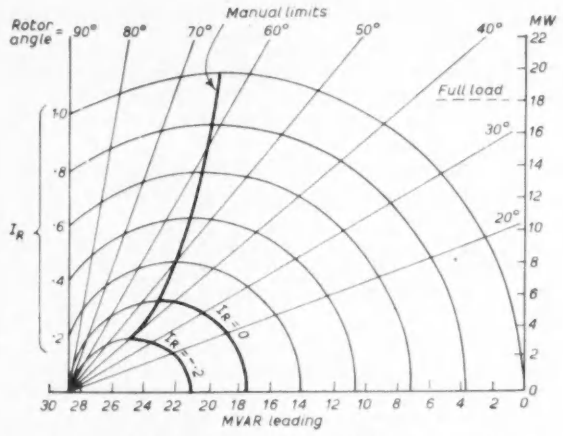


Fig. 8. Manual limit for stability of water-wheel alternator (salient pole) 18·95 MVA, rating $X_e = 0$, $X_d = 1·09$, $X_q = 0·66$

by rotor excitation. In magnitude it is proportional to the rotor current, and the angle θ which I_r makes with I_s is the rotor displacement angle, i.e., the angle the rotor advances from the no-load position as the load is applied. With the alternator on no load, if the rotor current is set at the open-circuit value to make $e_t=E$, then when connected to the system no current will flow, i.e., $I_r=-I_s$ and θ=zero. Unit rotor current can be specified as this value, the scale relationship between rotor and stator per unit current is: unit rotor current$=1/(X_d+X_e)$ units stator current.

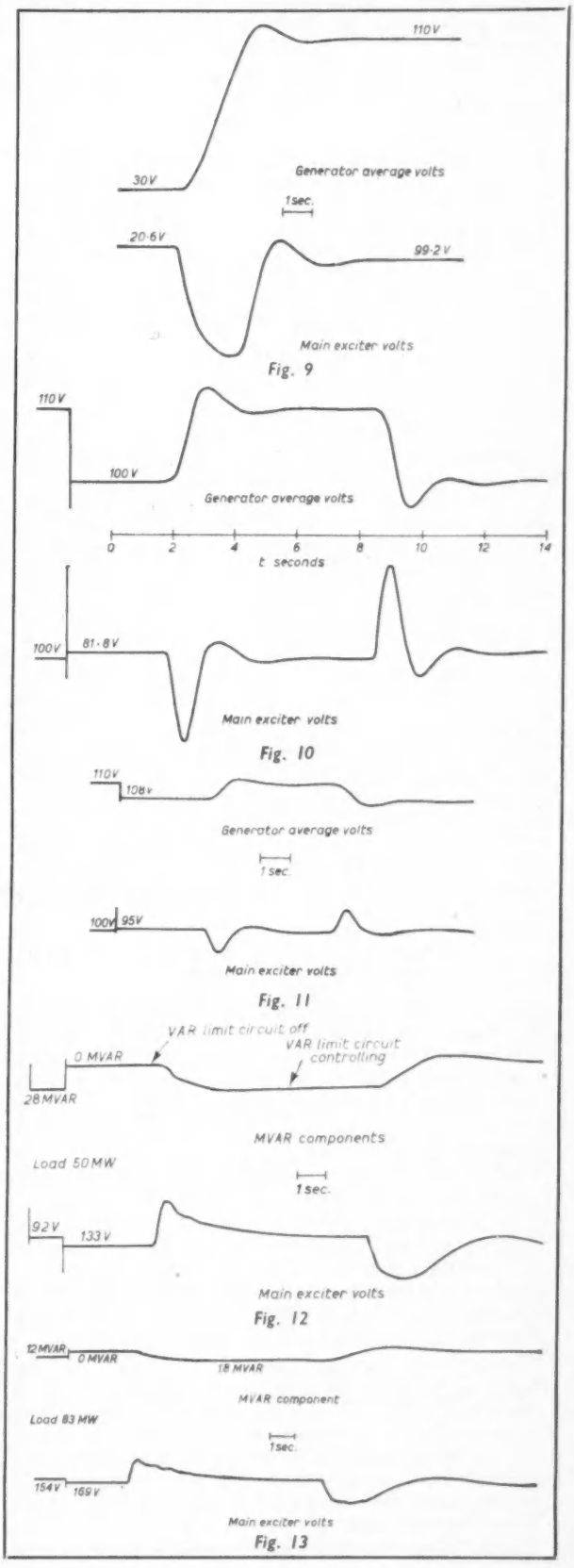
On manual control, the maximum power for any given excitation is when I_r is parallel to E, for this θ is 90°. If θ exceeds this, the electrical load is reduced (I follows locus of I_r) and the alternator would lose synchronism. The line $\theta°=90°$ is therefore the stator current stability limit line on manual control for the cylindrical rotor machine. It is of interest to know how salient pole effect compares and in this case, Fig. 8 is a typical example. The line for maximum power on manual (stability limit) does not correspond to $\theta=90°$ in this case.

With automatic voltage control it is possible to operate stably at rotor angles in excess of 90°. In Fig. 6 a current vector OB=1·05 units corresponds to a rotor current of $I_R=1·5$ units and rotor angle $\theta=112·5°$. If the a.v.r. is adjusted to operate at a slightly lower voltage, the initial effect is to reduce I_R. This initial action is in the wrong direction, but surplus power is thus created which causes the rotor angle to increase, and this in turn causes the alternator voltage e_t to reduce until it becomes less than the new operating level. When this point is reached, the

Figs. 9 to 13. Response curves obtained in tests of alternator controlled by electronic exciter

These tests were made on a 100 MW, 0·8 p.f. 13·8 kV 3,000 r.p.m. alternator. Figs. 9, 10 and 11 show the result of response tests with a step change of voltage, obtained by shorting out resistance in the control circuit. Fig. 9 is a step change 30 V to 110 V, Fig. 10 from 100 V to 110 V and Fig. 11 from 108 V to 110 V. These are equivalent to nominal steps of 80%, 10% and 2%.

Figs. 12 and 13 illustrate the stability of control with the VAR limit operating. In both tests, the initial load of zero MVAR was below the limit of operation of the VAR limit circuit. A step exchange of control was made by shorting some of the control circuit resistance, which would normally have the effect of driving the alternator far into the leading MVAR region. The VAR limit circuit comes into action and limits the MVAR swing as shown. Fig. 12 applies with 50 MW initial load, Fig. 13 with 83 MW initial load.



a.v.r. increases the excitation, enabling more electrical power to be transmitted and so slows down, and reverses the tendency to increase rotor angle.

The locus of stator current under these transient conditions is shown in Fig. 6 for a change from OB to OC amps, stabilising at OC which is the correct current for the new operating voltage, at the same time satisfying the loading requirement (same in-phase component as OB).

Operation at rotor angles greater than 90° is therefore a practical possibility with automatic control. There is still a limiting angle less than 180° at which dynamic stability is lost. This limiting condition can be determined by test, but it is necessary to work with an operating margin, depending on the magnitude of possible system disturbances.

Present practice is to limit operation to angles a little below 90° and to provide a circuit with the special function of automatically opposing operation beyond the selected limiting locus of stator current.

Method of setting up limit line. The alternator performance diagram, Fig. 7(b) is drawn with alternator voltage e_t as the reference ($e_t=1{\cdot}0$) instead of the system voltage E which is now assumed to be variable. Fig. 7(b) can be deduced from Fig. 6 if current vectors are adjusted to the level to suit $e_t=1{\cdot}0$; e.g., with I_r zero, $E=1{\cdot}111$ units, $I_s=0{\cdot}555$ units. Note that relative to e_t the manual limit line now becomes the curve shown.

For constant alternator volts (e_t) Fig. 7(b) can also be plotted in per unit kW and kVA to the same scale if $e_t=1{\cdot}0$. The scale correction for other values of e_t will be in proportion to $(e_t)^2$.

Referring to Fig. 7(a), a relationship between I and I_R is selected and this is then plotted on Fig. 7(b) and identified as a typical VAR limit line. From this it can be seen that other limit lines may be set up by varying the relationship and I holds with I_R.

What is now required is that if the stator current I exceeds the value laid down for the limit at any given I_R. then the VAR limiter should come into action and pass a signal to the control to increase excitation.

VAR Limiter Magnetic Amplifier. This single ended-magnetic amplifier is excited in three ways:

(1) Negative excitation proportional to alternator d.c. voltage reset signal.

(2) Negative excitation proportional to rotor current.

(3) Positive excitation proportional to stator current (d.c. signal).

Referring to Fig. 7(a), the limiting condition for zero power factor is $I=0{\cdot}42$, $I_R=0{\cdot}25$. Signal (1) is adjusted until the magnetic amplifier begins to give output at this load.

Next, with load on the alternator, e.g., 0·87 units kW, adjust (2) until output begins to appear from the VAR unit when $I=0{\cdot}9$; $I_R=1{\cdot}7$ as shown or when leading kVA is 0·22 units. The rotor current is measured by direct-current transformer (saturable reactor), providing electrical isolation from the rotor circuit.

Referring back to Fig. 1, the VAR limiter circuit is shown symbolically with its output feeding into a resistance in the control circuit, through a rectifier which blocks off the output below the level of the volt drop produced by the reference current flowing in this resistance. When conditions force up the output of the VAR limit circuit to make the blocking rectifier conduct, then the unit is able to impress its voltage on the control circuit. This additional voltage is in the direction to increase excitation on the alternator.

Another way of describing the action is if the operator removes too much resistance in the AVR trim control, and so makes an excessive reduction in reference voltage, the VAR limit circuit injects a compensating voltage into the control.

The author wishes to thank the English Electric Company for permission to publish this paper, and for facilities in the preparation of diagrams.

Sweden Orders 400 kV Shunt Reactors

ONCE again, the Swedish State Power Board has taken a pioneer step for the extension of their 400 kV network. Contracts have been placed for 400 kV shunt reactors, each rated 150 MVAr three-phase, for the Hallsberg transformer station in southern Sweden.

The reactors will be forced-cooled and designed for an insulation level of 1,550,000 V maximum, for a 1/50 microsecond full-impulse wave test. Their total weight is estimated at 180 tons.

The decision to adopt reactors directly connected to the high voltage line instead of the more usual technique of connection to a tertiary winding on the station transformer was taken after a full examination of conditions affecting system stability which will apply when the new link from the north of Sweden is completed in 1962.

Most of Sweden's generating capacity depends on the hydro-electric resources found in the northern areas, while the industrial load is concentrated in the south. Transmission distances of between 400 and 650 km are needed to link the generators to the load. The extensions to the system will retain the 400 kV transmission voltage, since a recent study showed only slight economies to be possible with higher voltages.

The reactors will be installed at the southern end of the lines, supplementing other methods of reactive compensation, which include series and shunt capacitors and synchronous condensers.

The contract for the reactors has been placed with the Belgian firm Ateliers de Construction Electriques de Charleroi (ACEC), who have considerable experience in the design of transformers and reactors for very high voltage networks. The reactors, which are claimed to have the highest rating in the world, will enable the system transformers to be designed more efficiently, one reason being that the losses normally associated with the reactor tertiary will be eliminated.

However, there are many problems which had to be solved in designing the reactors for so high a voltage. For example, under short-circuit conditions, serious problems of vibration and resonance may arise. It was also necessary to design the units so that the reactances in each phase would be equal to within 0·5% to ensure that no interference was caused on telephone lines as a result of zero sequence earth currents.

The manufacturers claim that so complicated was the reactor design that conventional manual techniques would have taken 16,000 hours to complete. However, this time was considerably reduced by using both an analogue model and a digital computer.

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

School Lighting

I HAVE read with interest your article (14 July) on Blackpool's fluorescent lighting in schools. I do hope that engineers of other authorities will not be forced or tempted to use industrial trough reflectors in classrooms. First, because I do not see how a fitting with a 20° cut-off housing a lamp with a luminance of 6 Cd/sq in., i.e., 2,700 ft-L can comply with the School Premises Regulations, which lay down limits of 1,000 ft-L average and 1,500 ft-L maximum above the 45° cut-off.

Secondly, it is the aim of modern lighting systems to create a good visual environment and the brightness ratios of the walls, ceilings, luminaires, require careful consideration. A trough fitting can never satisfy those conditions because the 2% upward light does not really improve matters.

Thirdly, the appearance of such fittings does much to lower the prestige of lighting engineers in the eyes of architects and others with taste.

R. Croft,
THE CORPORATION OF GLASGOW, ARCHITECTURAL AND PLANNING DEPT., GLASGOW C.1.

* * *

WHILST I have every sympathy, and agree in the main, with the points raised by Mr Croft, I am sure he will appreciate that all lighting installations are essentially a compromise, in which economics play an important part and the prime concern must always be to provide adequate illumination on the working plane.

To relight over 30 schools is a major project and it was necessary to choose a lighting installation for classrooms which would provide maximum illumination at minimum running costs with the choice of fittings inevitably conditioned by finance. Taking a realistic view, though aesthetic standards may have tended to suffer, I am sure it is correct to first consider the utilitarian aspect and thereby provide the proper levels of illumination for children to work under as speedily as possible.

Although this type of trough fitting has approximately a 20° cut-off, at a mounting height of 9-10 ft with an average illumination level of about 15 lumens/sq ft, glare only slightly exceeds the recommended values and the visual environment is reasonably satisfactory with slotted top reflectors.

H. Carpenter, M.I.E.E., F.I.E.S.,
DIRECTOR OF LIGHTING AND ELECTRICAL SERVICES,
COUNTY BOROUGH OF BLACKPOOL.

275 kV Underground Cables

IN his letter under the above heading in the issue of 11 August, 1960, "Chartered Engineer" concludes with the remark: "With the advent of pipe-line cables to commercial standards of reliability . . ."

This statement could infer quite erroneously that steel pipe-line cables have only recently been accepted as reliable. In fact, they have a long and successful history starting with the Ferranti cable installed in 1890. The first underground gas pressure cable used a steel pipe. This was a 66 kV three-core compression type installed in London in 1932 and still working satisfactorily. Since that date some 300 miles of steel-pipe cable has been installed in Europe. In the USA practically all high-voltage underground cables are in steel pipes and there is now some 700 miles in service. A similar situation exists in France.

In this country their use is also extending, for example, the steel pipe compression cable was chosen for an important 275 kV installation at a nuclear power station. Among many advantages such as the ability to use three-phase cables irrespective of size or voltage and the facility with which cables of large sizes can be substituted as load dictates, the outstanding feature is the large measure of protection provided against mechanical damage.

All these facts have been well known and amply demonstrated by service experience for more than 20 years; it is, therefore, difficult to understand the basis of the observation quoted above.

Another Chartered Engineer.

Earthing To Water Mains

IN your issue of 11 August, I note that *Megohm* discusses the practice of earthing to water mains. He says: "Is the time approaching when even the water authorities will have to be approached for permission to use their main as an earth? I would not be a bit surprised if this situation did arise . . ."

I would suggest that Clause 4 of Appendix E of the IEE Wiring Regulations does, in fact, already require this.

W. M. Bennett, M.I.E.E., M.CONS.E.,
MACKNESS AND SHIPLEY,
LONDON, S.W.1.

[Clause 4 says: An earth-connection shall only be made to a buried water-main or water-pipe after notice to, and in a manner approved by, the water authority concerned.—ED.]

Electricity in the News

IN his Notes on Wiring of 11 August, *Megohm* asks why it is that we get so little news of electrical matters in popular Press reports.

It is surely not the case that reporters know more about carpentry joints and plumbing than electrical matters. It is more likely that the average reporter knows nothing about the building trade and can only describe what he sees or what is explained to him.

The lack of information about electrical affairs in the popular Press is surely caused by the industry itself, due to its complacent, insular attitude to most aspects of publicity, spurred on by its motto: "The electrical industry is its own best customer."

Most material issued by electrical manufacturers for Press purposes is couched in such jargon that it can only be interpreted by electrical engineers. It fails to recognise that the persons who control the purse-strings and who wish to know whether a new development or product will

benefit their company are not always engineers. They are often accountants, solicitors and the like, who are only interested in "what does it do?" and "what does it save?".

Technical information is of the greatest importance for publication in the technical and trade Press. However, to capture the attention, via the popular Press, of the person who foots the bill in the end, whether industrialist or domestic user, demands a different approach than is general in the industry at present.

E. Joyce,
PURLEY, SURREY.

Old Wattmeters

THE pendulum-operated wattmeter referred to by Mr Jenkins (Problems and Practice, 4 August) is undoubtedly the Aron clock meter; he will be interested to know that several of these instruments are still in use; many more are employed in museums, colleges and schools for instructional purposes.

It is an accepted fact that Dr Hermann Aron was the foremost pioneer in this method of metering, his first clock meter being patented in 1883. Throughout its long history it has been recognised as the most accurate and reliable method of metering a direct current supply.

One of the earliest type of Aron clock meters, bearing a test certificate dated 4 May, 1890, reposes in this company's boardroom at Kilburn; others, all of which are still in perfect working order, are in the company's museum collection and may be viewed by appointment.

R. Fennell,
SALES CONTROLLER,
ARON ELECTRICITY METER LTD.

SUPPLY YEAR IN N.Z.

FAVOURABLE hydraulic conditions and commissioning of thermal plant enabled New Zealand to get through the supply year ended 31 March, 1960, without the need for restrictions on power use. This is recorded in the report of the New Zealand Electricity Department, published recently. On the North Island, a maximum demand of 862·9 MW was met in June, 1959, and on the South Island a maximum demand of 414·3 MW at the end of May. Total generation in the two islands was 4,420 million units and 1,940 million units, respectively, increases of 13·5% and 8·7% on the previous year.

System Operation

The report is concerned with operation of the supply system rather than the constructional activities covered by the Ministry of Works report (ELECTRICAL TIMES, 4 August). It includes details of even minor breakdowns, faults and repair activities on the generating stations, substations and transmission lines operated by the department. Experience with the 220 kV system is reported as being comparatively satisfactory, at least in respect of lightning. Five lightning strikes on a 220 kV line in the North Island caused no interruption, but one of two strikes in the South Island caused an interruption because abnormally high resistance at the faulted tower had the result that relays did not function successfully.

The report draws attention in many places to the difficulties caused by birds and small animals. Numbers of faults were caused by these, the chain of events leading to serious trouble sometimes being quite complex. Such a case was that of an opossum which caused an arc across the terminals of an 11 kV regulating transformer at a 110 kV substation. The earth protection failed to operate because of corrosion of a plunger in the trip solenoid and the arcing continued for about two minutes. This caused a fire at the incoming cable potheads, and smoke from this fire apparently caused a flashover to occur across the bushing of a nearby 110 kV o.c.b. This was cleared by a 110 kV breaker at the distant end of the line; three transformers were severely damaged as a result of the fault.

Future Plans

The section of the report concerned with future planning, of course, makes reference to the inter-island submarine cable project, now under consideration in the light of the consultants' comments. Another major project under discussion is establishment of an aluminium manufacturing industry in South Island. Power requirements of this would exceed present demand of the whole of South Island, and the company concerned has been given the right to develop its own power station if investigations show this to be practicable.

Progress with generation at the geothermal site at Wairakei is considered, in the words of the Minister of Electricity, "a fair indication that power from geothermal steam is a reality." A maximum output of 60 MW was reached during the year. The worst trouble experienced was with gas exhausters. Altogether, Wairakei generated 169 million units during the year at an effective load factor of 37·9%.

The section of the report dealing with design and project planning notes is specially interesting, the purchase of a three-terminal relaying scheme for a 220 kV line from Livingstone to Islington, which is teed without circuit-breakers to Waitaki. This application has involved difficulties in suiting relay sensitivities to extremely low fault currents for some types and locations of faults. Power line carrier current inter-tripping features are to be incorporated in the scheme for all three terminals, with high-speed automatic reclosure at the Livingstone and Islington terminals.

Plans for a 500 kV d.c. line were carried to the stage where the route survey was complete and line tower designs were under consideration.

Regulations

The electricity department is concerned with administering compulsory registration schemes and the like, and the report notes that besides examinations of electricians, work was started on training and certification of electric linesmen; a register of linesmen is being prepared and regulations for their certification have been drawn up. The New Zealand Electric Wiring Regulations have also been under revision. Total electrical accidents reported in New Zealand during the year were 131, of which 14 were fatal. There were 292 fires attributed to electrical causes, not less than 222 being blamed on electric blankets and heating pads. Only five were attributed to fixed wiring, and two to flexible cords.

"Phasing out" e.h.v. cables

AN OUTLINE OF ACCEPTED PROCEDURE

CHECKING phase sequence constitutes one of the essential routine tests undertaken before connecting new cables and transmission lines. The "phasing out" test, although relatively simple, can be made in various way and four of these are described.

A "phasing out" test is always necessary before new a.c. circuits are commissioned to ensure satisfactory operation of the transmission or distribution network after the new circuit has been connected.

The importance of this test may be made quite clear by a simple example. Consider a supply to a factory by mains, duplicated as a safeguard against breakdown. The cables are connected to one side of a three-phase switch, the consumer's main busbars being connected to the other side of the switch.

The alternative circuit, which has been installed as a "standby" in the event of a fault occurring on the original circuit, is connected to another three-phase switch and the other side of this switch is also permanently connected to the consumer's busbars.

Now suppose that the red phase of the original circuit is connected to one of these busbars through its switch, whilst on the alternative circuit, the yellow phase is connected, through its switch, to the same busbar. Provided only one of the main switches is closed, normal service will be obtained, but if both circuits are closed there will be a direct short-circuit between the red and yellow phases.

It is, therefore, essential that only conductors coming from the same phase of an alternating current source of supply are directly connected and to ensure that short-circuits will not occur due to different phases being directly linked together, "phasing out" tests are necessary whenever an alternating current system is modified or extended.

In the case of e.h.v. cables, a "phasing out" test is normally made before the cable is commissioned. The test is made after laying and jointing, but before high voltage d.c. testing.

Simple Tests

Several methods of carrying out the tests are in common use. Two of these are described below using a "Megger" or, alternatively, a low voltage battery and voltmeter.

For the "Megger" test, the conductors at one end of the route are connected in turn by a short piece of wire to the metal sheath. At the other end, insulation resistance tests between conductors and metal sheath are made with a "Megger." A zero reading on the "Megger" indicates the conductor, which has been connected to the metal sheath at the far end; e.g., if the yellow phase has been earthed at one end, a zero reading on the "Megger" indicates the yellow phase at the other end.

Unless it is possible to arrange for telephone communication between the two ends of the route, this method involves three journeys from one end of the cable to the other and, therefore, takes a considerable time.

As an alternative test, a low-voltage battery may be used. At one end of the route, each cable conductor is connected to different terminals of a grid bias battery, e.g., the red conductor is connected to the positive terminal and to the metal sheath, the yellow conductor to the 5-volt terminal and the blue conductor to the 10-volt terminal. A note is made of the voltages applied to each conductor. Voltages on each conductor measured at the other end by means of a low-reading voltmeter, such as an Avometer, identify the cable cores. By this means, each conductor at the far end can be identified.

This method is much quicker than the "Megger" method because it involves only one journey from one end of the route to the other.

Additional Tests

When, as is normally the case, an additional check for correct phasing is required on a line circuit before it is switched in, "phasing rods" or voltage transformers are necessary. Of these two types of equipment, voltage transformers are considered to involve less risk of accident and are more generally used because they can be used with comparative safety on circuits operating up to the highest voltages.

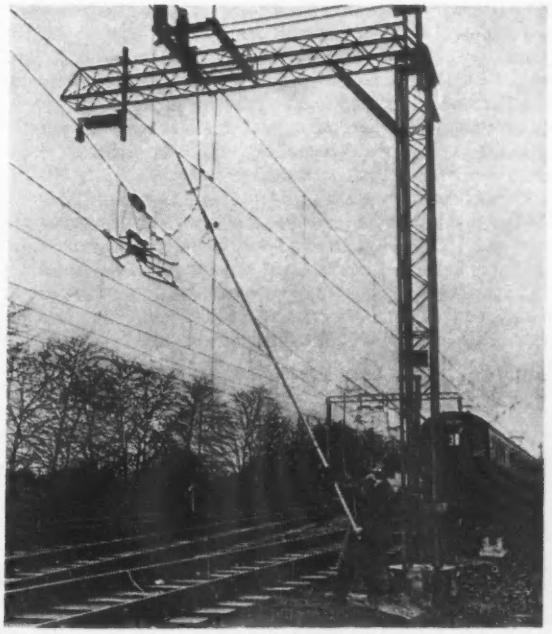


Fig. 1. A recent development of the Ferranti high voltage indicator in use on a 25 kV overhead railway line. Similar indicators are used for "phasing out" tests on high voltage cables and lines

Tests with Phasing Rods

Phasing rods comprise essentially two insulated rods, each with a short spike at one end which is connected by suitably insulated flexible leads to an intermediate electrostatic voltmeter.

It is, however, recommended that these insulated rods should have been adequately tested before use and preferably be obtained from reliable manufacturers—the high voltage indicators which take the form of an insulated rod provided with associated voltmeters and connecting leads made by Ferranti Ltd. are admirable for the purpose.

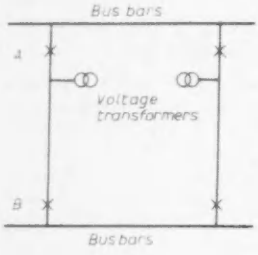


Fig. 2. Single-line representation of duplicate cable connections between busbars. The correct sequence for "phasing out" using voltage transformers is described in the accompanying text

When carrying out the tests, one lead of the intermediate voltmeter is clipped to one terminal of the voltmeter on one of the high voltage indicators and the other lead from the intermediate voltmeter is clipped to one terminal of the voltmeter on the other indicator.

The spikes at the top of the indicators are then carefully applied to the phase terminals to be tested. If the spikes have been applied to the same phase in each case, there will be no reading on the intermediate voltmeter. If, however, the intermediate electrostatic voltmeter indicates the supply voltage, it follows that the spikes on the high voltage indicators have been applied to different phases.

Voltage Transformer Method

The single-line diagram Fig. 2 represents two sets of three-phase busbars, connecting cables, three-phase switches and three-phase voltage transformers. It can be assumed that the busbars, switches and voltage transformers are in separate substations situated at different localities on a transmission system and it is desired to check the phasing of the new cable, safely and conveniently, by taking voltage readings from the secondary side of the voltage transformers.

The following procedure should be followed:

(i) Prove that the primary and secondary connections of the voltage transformer connected to the new cable are correct by checking the secondary voltages against the proved voltage transformer connected to the original parallel circuit as follows:

Switch B is left open but switch A closed. The voltage transformers, at this stage, are, therefore, energised from the same source. Voltage readings are then taken between the terminals of the secondary windings of both voltage transformers and, assuming no reading is obtained when the voltmeter is connected to similar phase terminals, it can be assumed the primary and secondary connections of the voltage transformers are correct.

(ii) Switch A is now opened and the new cable energised by closing switch B. Similar voltage readings are then taken between the terminals of the two voltage transformers and if the phasing of the new cable between switches A and B is correct, there will again be no reading on the voltmeter when it is connected to similar phase terminals on the voltage transformer secondaries.

Occasions may arise, however, when for the sake of safety it is decided to use the voltage transformer method, but when the voltage transformers connected to the circuit are not accessible at the location where the phasing out tests are to be made. In such cases, and provided the two circuits on which the phasing is to be checked can be switched out whilst connections are made, single-phase voltage transformers which can be made available from a nearby substation, or from the stores, can be used.

In this case, the terminals of the primary winding are connected to each of the terminals of the two circuits which have to be "phased out" and voltmeter readings taken from the terminals of the secondary windings of the voltage transformer. If no readings are obtained on the voltmeter this indicates that the primary windings of the voltage transformers have been connected to identical phases.

U.S. 40 kW linear accelerator

CONSTRUCTION work will soon begin on a powerful linear accelerator ordered by the US National Bureau of Standards and scheduled for installation in 1962. The accelerator will form part of a new laboratory facility for the NBS at Gaithersburg, about 20 miles north west of Washington D.C.

The accelerator will be known as Linac and will consist essentially of a 100 ft-long straight steel pipe in which electrons will be accelerated "on the crest of a travelling microwave." The accelerator is designed to produce peak energies of up to 150 MeV and power outputs of 40 kW or more.

A contract for the accelerator at an estimated cost of $1·7 million has been placed with the High Voltage Engineering Corporation, of Burlington, Massachusetts, who have built a great number of particle accelerators.

Power output from the new accelerator is expected to be about 100,000 times as great as is obtained from existing accelerators operated by the Bureau.

Linac will be installed below ground level to make use of the effective shielding provided by an earth overlay. Individual radiation laboratories will be shielded by 12 ft thick concrete walls. It will be an L-band accelerator, operating at a frequency of 1,300 Mc/s and powered by 12-5 MW peak, klystron or Amplitron tubes. The electron beam current will have a peak value of 0·25 A and the pulse duration will be variable from 0·1 to 6 microseconds.

Linac will emit high energy electron beams and other intense radiations such as X-rays, positrons and neutrons. It will be used for research into low temperature chemistry, metallurgical studies and for determining the properties of irradiated materials.

The size and layout of the new laboratories will make it possible to have four time-of-flight tubes ranging in length from 100 to 800 metres. These will be used for measuring neutron cross-section and the energy spectra of photoneutrons.

Nuclear reactor design will also be expanded with the new accelerator, through study of the effects of radiation and an important use for Linac will be to evolve standards for radiation dosage. The new accelerator will provide a dose rate of 10^9 rads per minute, which, when used with dose rates from existing cobalt, radium, X-ray and electron beam sources, will make it possible to investigate all dosimetry problems expected in the foreseeable future.

NOTES ON WIRING

BY MEGOHM

CERTAIN contractors continue to express their dislike of "fixed price tenders" and the pending rise in labour costs, arising from a reduction in hours, is likely to reinforce their objections. Is this really a fair type of tender? I don't think so, personally, for the contractor has more or less to take a gamble on possible increases during a contract which he tenders for, perhaps, months before the work starts. In this fast-moving world of today anything can happen, and short of another world conflict the contractor has no let-out.

When this type of tender came into being, many contractors welcomed it because the time spent pricing the "rise and/or fall" of labour and materials costs often proved more expensive than any increase. Now, I fear, opinions are altering. When working hours are reduced to 42 hours per week, I wonder how many sites will work 42 hours only? Not many, I feel sure, and the overtime costs may well put the contract "in the red." Many engineers engaged inside the contractors' offices must be looking at their tool kits and wondering whether they should get them ready for use.

Old Wiring

I know of an office in London where the existing system of "capping and casing" is being removed to make way for something more modern. I can recall seeing this type of wiring installed in a "stately home" when I was quite young and remember the care taken by the electrician, who had been at one time a carpenter by trade. I had a look at the system in the office mentioned above and marvelled at the condition of the cable. It had gone hard but was reasonably safe, even after the many years it had been in use, and that included the years when enemy action shook the foundations of the office. Again, it was quite obvious that the person who had installed the system had been a real craftsman. Changes of level in the ceilings, etc., had been carefully overcome by diligent cutting of the casing and it was a pleasure to see such fine work. Let us hope that when the time comes to rip out those systems being installed today, the engineers of the future think the same of our work.

Heights of Switches and Sockets

At a recent meeting of the National Federation of Housing Societies an occupational therapist stated that handicapped people often find light switches and sockets inconvenient due to the heights that these are normally installed. The impression given is that they are sited too low for comfort. The normal height for switches is 4 ft 6 in. from the floor and this has been standard practice for many years now. Is it the best height for switches? Or would they be better at 5 ft from the floor? How often in a half-tiled room do we find the switch sited at 5 ft and feel that we are "reaching" for it?

Personally, I think the 4 ft. 6 in. height is ideal except for the smaller, younger members of the family who might find it a bit difficult to switch on the lights. Sockets, too, are often, in my opinion, incorrectly positioned as far as height is concerned. It was the policy in days gone by to site the socket in or on the skirting board, but in recent years the trend has been towards siting them where they are more easily reached. Of course, such changes lead to arguments. With the socket sited at skirting level, the flexible cord was not in the way but many people have pointed out to me the inconvenience caused by the flexible cord hanging from a socket sited at 18 in. from the floor.

I feel that the problem really revolves around one's ideas and desires. I find it no inconvenience having my sockets at 18 in. from the floor (in the kitchen they are at 4ft 6in.). No trouble has been experienced with the flexibles to fires and radio, but those serving the iron and the vacuum cleaner do present problems. The cleaner invariably stops because the cord has tightened and the plug has dropped out. If, however, the vacuum is served from a plug at 4 ft 6in. in the kitchen the cord merely tightens and the plug does not come out unless there is an appreciable strain on the cord. Perhaps the cable entry on the vacuum cleaner is just right in line with the height of the sockets in the other rooms.

All very interesting, but I don't think that we shall see the "standard" drill for siting switches and sockets alter very much. Also, when people build houses today they think of such things as heights of switches, etc., far too late in the day to be any use.

Press Comment

My recent comments about the popular Press and its lack of news about electrical matters has brought forth some interesting views. One reader suggests that the electrical industry itself is to blame because of its complacent attitude to publicity. Manufacturers' advertisements are, says my reader, worded in such a way that only electrical engineers can interpret them. I am inclined to agree with him to some extent, although certain accessories manufacturers have tried to reach the ordinary householder by producing booklets and catalogues showing their wares in colour and in positions where they best do their job. Local electricity centres advertise in the various local papers, but I find these advertisements dull and uninteresting, even when the people depicted therein are shaped to appeal to the male eye!

What do we want to read in the Press about our industry? One thing I have always felt should be more fully reported is the accident, fatal or otherwise, involving electricity. Casual reporting on such accidents in the home might well lead to a fear of using electricity. On the other hand, concise details of why the accident occurred may save someone else from a similar fate.

When new and interesting buildings are reported on in the Press, let us hear about the electrical installation and how it benefits the occupants. If the reporters do not know what has been done, let them be shown the system by an expert. Perhaps in time we may see a newspaper employ such an expert. I once met, by chance, a reporter who specialised in reporting on the farming industry and we cheerfully exchanged ideas on the use of electricity in farming and I was later delighted to read, some weeks later, of that journey and noted that he wrote with some authority on the subject!

OVERSEAS NEWS

from our correspondents abroad

AUSTRALIA

Snowy Mountain Scheme

Changes in layout and construction for the largest hydro-electric power station in the Snowy Mountains scheme are reported. Construction on the station to be known as Murray 1 will begin within 18 months. Murray 1 station will have a capacity of 760 MW which, incidentally, is more than half the entire installed electrical capacity in Victoria State. Engineers have found that a surface layout for Murray 1 station would be cheaper than the underground installation originally planned. The change in plan has been partially influenced by cheaper and more readily available high quality steel for surface pressure pipe lines. Murray 1 is scheduled to begin power production in 1966 and the last of the eight turbo generators is expected to be in operation by 1968. The station will have a 280 ft high rockfill dam on the Geehi River and a seven-mile tunnel to the generating station.

Under the revised plan for the Snowy-Murray development, the proposed reservoir at Jindabyne will have a capacity only a quarter of that originally planned at 25,000 acre ft.

An early start is also expected on another part of the Snowy-Murray development. This scheme, providing water for power and irrigation, includes a 15-mile tunnel from a new dam at Island Bend to the Eucumbene reservoir.

Queensland Rural Electrification

The Commissioner for Electricity in the State of Queensland, announcing a £1,650,000 loan which opened on 25 July, said a substantial proportion of this loan would be used to meet cost of supply to rural communities. The loan was offered to Queenslanders as a direct investment to be used entirely for State development.

Queensland has large rural electrification programmes planned for each year. For the year 1960-61 these plans include £6,250,000 for further rural electrification. Altogether, about £9 million has been paid in subsidies since the inception of the rural electrification scheme. In the past, development of marginal areas in Queensland has been based on a scheme of guaranteed revenue requiring a consumer to use, or pay for, a minimum amount of electricity. However, this scheme has not proved entirely satisfactory and it is recognised by the Commission that an obligation exists to complete, as far as practicable, network coverage of rural areas. This attitude, as a basis for a new approach to rural electrification, is now under consideration. It is estimated that approximately £17,200,000 will be required to complete rural electrification offering an average return of only about 5½%. Since there is no prospect of the areas concerned providing the required return, a scheme is being considered based on obtaining by guarantee the return which could be expected if all consumers used electricity to the maximum extent possible. Consequential losses would be absorbed by the undertaking as a whole. It is noteworthy that rural electrification in Queensland is already well up to world standards and is, in fact, said to be greater in proportion to total population than in Great Britain.

Appointments Wrangle

At a further stormy meeting of the Sydney County Council, NSW and the general manager, Mr C. E. Ranger, a short time ago, the latter said he would refer the dispute between himself and the council to the Minister for Local Government, Mr P. D. Hills (we referred recently to the origin of the dispute over the appointment by the Council of Mr G. Washington as chief engineer against the wishes of Mr Ranger who wanted Mr Maguire for the position). Mr Ranger has said that pending any alterations that might be made to the Gas and Electricity Act he would maintain the organisation which he considered necessary for the effective control of the undertaking. But at their latest meeting the Council carried another motion that no new staff classification be established without the Council being consulted. Moving that motion, Councillor L. Bowen maintained that the general manager had given no evidence to justify the appointment of an assistant general manager. It was a basic weakness of the Act if the general manager alone could appoint officers to senior positions. The matter was left to go to its Minister.

TRINIDAD & TOBAGO

New Transmission Line

Work began recently on a seven-mile long extension to the 33 kV transmission grid. The extension will link residents in the Cedros area, including the villages of Bonasse, Fullerton and Granville, to the grid, so enabling increasing needs of industrial consumers to be met. The new extension is estimated to cost $95,318 and will supersede a small existing generating plant at Granville.

Generation in 1959

Electricity generated in Trinidad and Tobago during 1959 was 18·7% higher than in 1958 at 221·4 million units. Trinidad has applied to the World Bank for a loan of WI $42 million for a large expansion programme, which will include enlargement of the Port of Spain power station. Consultants for this scheme are the British firm of Preece, Cardew and Rider.

SCANDINAVIA

First Tubular Turbine

Exploitation of water power resources not previously considered economically worth while are now said to be possible by a recently developed turbine. Development work on the tubular turbine has been proceeding by the two firms KMW and Asea for several years. Recently a 4,875 h.p. turbine of the new design, said to be the first in Sweden, has been commissioned at Skogsforsen power station in southern Sweden. The turbine operates under a head of 46 ft and runs at a speed of 250 r.p.m. It is essentially a horizontal Kaplan turbine directly coupled to an asynchronous alternator. The alternator stator housing forms an extension of the internal wetted perimeter of the turbine enabling a straight water way with essentially axial flow to be obtained.

Finnish Exhibition

The Finnish Fair begins in Helsinki on 16 Sept. The fair is essentially industrial in nature including products from the radio, electrical and lighting industries. The Finnish Industries Fair is held every five years and lasts for just over two weeks.

Sweden's Economy

Shortage of labour is now said to be restricting expansion of the industrial boom in Sweden. Industrial production which has risen monthly since last summer has shown a decline in recent months. There has also been a marked deterioration in the country's trade balance. Imports in the first five months of this year were 28% larger than in the same period of 1959, while the corresponding increase in exports was only 19%.

The Swedish firm of Ericsson has recently received its first large telephone order from Thailand. The order is worth about £345,000 and comprises delivery and installation of an automatic 10,000 line telephone exchange.

Swedish Nuclear Plant

A contract worth Kr 40 million for installation of a nuclear reactor at the Agesta heating plant, near Stockholm, has been concluded between the Hydro-Electric Power Board and ASEA.

Early in May, Sweden's third atomic reactor was started at Studsvik. The reactor is to be used for material testing and is of the modified pool type.

S. AMERICA

World Bank's Loan

A $25 million loan to Colombia spread over a 25-year period at 6% is to be used to double generating capacity in the Cauca Valley by building a new hydro-electric plant and adding to an existing thermal station. Most of the power will be used in the industrial centre of Cali, but the loan will also finance transmission line connections to 25 nearby towns. The loan is to the Corporacion Autonoma Regional del Cauca and Chioral. The projects financed under the loan include a new hydro-electric plant with a 120 MW capacity on Calima River and a 33 MW extension to the Yumbo thermal station.

British Factory for Argentine

Approval has recently been given to J. Stone and Co. Ltd., for the establishment of a £133,000 factory to manufacture train lighting, heating and air conditioning equipment. A £1 million plant for the manufacture of p.v.c. was recently inaugurated by an associate company of ICI Ltd.

Three European firms have recently signed a contract with the Ministry of Public Works for a comprehensive study of the Argentine transport system. Orders to prevent a breakdown of railway service have recently been placed with Hungarian, Italian and Japanese firms for the supply of nearly 400 diesel and electric railcars.

Brazil's Nuclear Power Plan

Prospects for nuclear power station constructors would seem to be brightening with the recent announcement of the Indian Government's 300 MWe nuclear programme and the further recent announcement of a Brazilian nuclear programme with the objective of building in the next five years 150/200 MWe nuclear power station.

The schedule announced by Minister Octavio Dias Carneiro, Director of the Brazilian Nuclear Commission, would seem to be rather tight since it involves completion of the station by 1966. Brazil and India do not seem to be deterred by the prevalent opinion in both Europe and the United States that nuclear energy is not competitive with other prime movers.

Both countries have vast territories to be developed with industrial centres few and far between and with the absence of an adequate grid inter-connection system: conditions which do not apply in more highly industrialised countries.

The site for the station has already been chosen on the banks of the Mambucaba River, 85 miles west of the capital, Rio de Janeiro. Specifications are now being drafted by the British Consultants, Messrs Kennedy and Donkin and tenders are to be invited from Britain, United States, France and Sweden.

Dominican Hydro Extensions

The Dominican Electricity Corporation is also planning extensions to its hydro-electric and thermal generating plants. To finance these developments, the corporation are issuing $12 million ten-year 6% Preference stock.

GHANA

Volta Loan Agreed

Agreement on a £30 million loan for the Volta River hydro-electric scheme has been reached after talks between Mr Gbedemeh, Ghanaian Minister of Finance and the World Bank, and the United States and British Governments.

The loan which includes a £5 million British share, will assist construction of the Volta dam and irrigation scheme. The Volta River project, which has been advocated for 20 years, will transform Ghana into an industrial country and hydro-electric power provided by the scheme will be used to smelt the rich bauxite deposits in Ghana. The British contribution is said to be conditional upon a satisfactory agreement being reached on the building of the aluminium smelting plant.

Although the British contribution is not large, it should be viewed in the light of our other substantial Commonwealth commitments. The loan will be for 25 years, and as yet the interest rate has not been disclosed. It is understood that the contribution from the US will be £10,700,000 and from the International Bank £14,200,000.

S. AFRICA

Hire Purchase Dispute

A controversy, familiar in our own industry, concerning hire-purchase schemes by public authorities is now raging in South Africa. The Association of Electrical Appliance Sellers are attempting to prevent Cape Town City Council operating their hire-purchase scheme for electrical appliances. The Sellers have submitted a memorandum to the Administrator for Cape Province alleging trespass on the field of private enterprise by the City Council.

The Council, on the other hand, claim that far from inhibiting private enterprise, their scheme has provided a stimulus to trade. It is expected that the dispute will be submitted to the Executive Committee of the Provincial Council for consideration. It may be recalled that some months ago there was a dispute between the Council and Appliance Distributors over rates of discount. The Council, who had been receiving only 15% asked for the same discount of 25% as was granted to private firms for appliances sold in the Council's showrooms. The request was rejected until the Council intimated that distributors would be required to remove their appliances from the showrooms if the larger discount was not forthcoming. Although some suppliers withdrew their appliances, they later reinstated them and increased the rate of discount as requested by the Council.

Athlone Station Progress

Satisfactory progress on Cape Town's new municipal power station at Athlone is expected to enable the first two 30 MW turbo-alternator sets to be operating by the end of the current year. The first of the sets is expected to be commissioned in October. At present, because of limited generating capacity at the council's Table Bay generating station, Cape Town is relying on a bulk supply agreement with Escom under which they are taking 120 million units in 1960 and a maximum demand of 28 MVA. Commissioning of the first two machines at Athlone this year and the expected commissioning of a third set in 1961 will permit a substantial reduction in this bulk supply. The figures for 1961 are expected to be 60 million units and a maximum demand of 14 MVA.

It will be recalled that the Athlone power station will have turbo-generators supplied by the Swiss firm of Oerlikon while the boilers are manufactured by John Brown Land Boilers (Africa) Ltd. Construction work on the second cooling tower, being built by Messrs. Christiani and Nielsen, is expected to be completed by the end of this month.

RHODESIA & NYASALAND

Nkula Falls Hydro Scheme

The Federal Government of Rhodesia and Nyasaland is urgently investigating the possibility of borrowing £3 million to finance a hydro-electric scheme on the Nkula Falls. The Federal Assembly have been asked to vote £100,000 for immediate planning to be undertaken on the scheme. The scheme, which has been accepted in principle, is considered the next logical step in supplying future long term needs of the Protectorate.

Lighting African Homes

A rather more elaborate scheme for lighting and power supplies to African homes in Southern Rhodesia's townships than the scheme in operation in Kenya has been submitted to the Government for approval. The scheme provides for street lighting and house lighting in the townships and is estimated to cost several hundred thousand pounds.

House wiring will provide for a light in each room and two 13 A plug points in each house. Estimated cost per house varies between £26 and £50 including the installation of a meter or load-limiter and the connection fee.

Personalities *in the industry*

Changes in the part-time membership of the Central Electricity Generating Board are announced by the Ministry of Power. At the end of this month **Mr G. A. S. Nairn,** M.B.E., F.R.S.A., retires on completion of his present term of office. His successor will be **Mr P. T. Menzies** (ESH, page 47), who is financial director of Imperial Chemical Industries Ltd. and a member of the board of the London and Lancashire Insurance Co. Ltd. Mr Menzies was educated at Edinburgh University, graduating as M.A. with first-class honours in mathematics and natural philosophy. From 1933-39 he served with the Board of Inland Revenue. The Minister of Power has also re-appointed the **Rt Hon Lord Geddes of Epsom,** C.B.E., as a part-time member of the Board.

The appointment of **Mr J. Banks,** M.ENG., M.I.E.E., as chief engineer, power cables division of British Callender's Cables Ltd., is announced. This fills the vacancy created by the promotion of Mr P. M. Hollingsworth to assistant chief engineer, BICC, which we reported two weeks ago. Mr Banks originally studied light current engineering at Liverpool University, where he gained a first class honours degree. He joined BICC to deal specifically with problems of thermoplastic cable development. In 1947 he was appointed head of the power cables laboratory at Prescot and in 1951 transferred to Wood Lane where he was responsible for power cable and accessory development. On the transfer of all power cable development activities to Erith he became chief development and test engineer, and was responsible for the design of the new high voltage laboratory. More recently Mr Banks has been concerned with important overseas projects, including the 230 kV Vancouver installation and the 330 kV cables for Kariba.

Following his appointment as High Commissioner of the Federation of Nigeria, the **Rt Hon The Viscount Head of Throope** has resigned from the board of AEI, of which he has been a member since 1957. Filling the vacancy, **Sir Joseph Latham,** C.B.E., has been elected a director. Sir Joseph, who is a chartered accountant, has long been associated with the coal mining industry and from 1956 until recently had been deputy chairman of the National Coal Board. An additional appointment to the AEI board is that of **Mr C. R. Wheeler,** C.B.E., as an additional vice-chairman. Mr Wheeler, who is at present chairman of Guest, Keen Iron and Steel Co., will not take up executive duties until 1962, it is stated.

The two home sales divisions of Firth Cleveland Instruments Ltd., dealing with industrial instruments and aircraft instruments are to be merged. **Mr S. F. Smith,** previously with the former division, becomes home sales manager of the company with **Mr H. F. Bagley** as deputy sales manager. In addition to his overall duties, Mr Bagley will continue to have full responsibility for sales and commercial administration concerned with aircraft instruments.

Mr L. G. Harris who, since his retirement six years ago from Simplex Electric, has been with the Liverpool wholesalers, F. K. Smith Ltd., is now retiring from the firm.

Joining the staff of the Birmingham sales office of the Electric Construction Co. Ltd. is **Mr J. H. Rowley,** B.SC., who has previously been with A. Reyrolle and Co. He succeeds **Mr W. L. Harrison,** who has been appointed manager of the furnace division of GWB Furnaces Ltd.

Mr F. A. Clifton has been appointed manager of the AEI private telephone department in Birmingham, succeeding **Mr S. W. Hayes** who, although retiring, will continue to act in a consultative capacity. Starting with the telephone department of Siemens Brothers in 1924, Mr Clifton had wide experience in the installation of private automatic telephone exchanges in various parts of the country and, in 1937, became assistant to the chief maintenance engineer. During the war he was seconded from the RAF for special duties with the Government communications headquarters. He returned to Woolwich to look after the supply of raw materials, transferring to Upper Thames St in 1947 and to West Kensington section in 1955. For the last 18 months he has been deputy to Mr Hayes. Originally a member of Telephone Installations (London) Ltd., Mr Hayes continued when the company was taken over by Siemens in 1935. He has been manager in Birmingham for the last eight years.

On a round trip of Commonwealth countries, **Mr E. O. Chapman,** sales manager of Gent and Co. Ltd., flying by way of America, will visit New Zealand, Australia, Pakistan, Kenya, Rhodesia and South Africa.

Three new representatives have been appointed by R. B. Pullin and Co. Ltd. in their expanding thermostat division. Formerly with the GEC, **Mr D. S. Crichton** takes over the North London area; **Mr A. Robinson,** who becomes responsible in the N.W., was with Wilkins and Mitchell; and the Midland counties will be covered by **Mr P. K. Smith,** formerly of Parmeko.

In the integration of the AEI Woolwich Group, a new East Anglian district office has been set up covering Norfolk, Suffolk and the northern half of Essex. The first manager is **Mr S. L. Crafford** who joined Henley's in 1924 and subsequently was in charge of their sales promotion department. In 1946 he was appointed to Henley's Colchester branch office and, for the present, will continue to operate from that office. Mr Crafford is a past-president of the Colchester Engineering Society.

After 40 years' service **Mr R. B. Hill,** joint home sales manager (power, rubber and plastics cable), AEI cable division, was recently presented with a gold watch by **Mr E. J. Vidler,** joint divisional

Mr S. L. Crafford

Mr F. A. Clifton

Mr J. H. Rowley

Mr J. Banks

Mr R. B. Hill, centre, with gold watch presented on completing 40 years' service. Left, Mr E. J. Vidler, right, Mr H. D. Parsons

general manager. Mr Hill started at Henley's as an estimating clerk in 1920 and by 1938 he was in charge of the rubber cable section. In 1950 he became chief assistant sales manager, later being appointed manager of the cable sales department until he received the present appointment under the new AEI cable divisional structure.

Referring to the recent expansion in the Morphy-Richards sales force outlined in our issue, 11 Aug., we have been asked to make clear that all the appointments were of area managers.

AEI have appointed **Dr D. C. Milner**, M.A., as editor of their new technical journal, replacing the journals of the former separate companies. Dr Milner gained his Ph.D. for work in the field of molecular spectroscopy.

Mr G. A. Dwyer has arrived in India this week to take up the position of representative of the Marconi International Marine Communication Co., for India and Ceylon.

In board changes in the Cossor group, **Mr G. G. Roberts** has been appointed technical director of Cossor Radar and Electronics and **Mr N. Elson** technical director of Cossor Communications.

Mrs C. Renton-Taylor, of Leeds, has been re-appointed by the Minister of Power as a part-time member of the Yorkshire Electricity Board.

After serving for eight years as chairman of the North Western Electricity Consultative Council, **Mr F. Kenyon** is retiring at the end of next month. As his successor, the Minister of Power has appointed **Sir Raymond Streat**, K.B.E., of Wilmslow, Cheshire.

Mr W. R. Mills has recently joined Stanley Works (GB) Ltd. as general sales manager, taking over the duties previously carried out by the sales director.

As announced elsewhere, Hartley Electromotives has been disposed of by Hartley Baird and in consequence **Mr J. L. Symonds** has resigned from the latter board, while remaining managing director of Hartley Electromotives.

Mr F. J. Burn has been appointed deputy chairman of Dubilier Condenser Co. (1925) Ltd.

OBITUARY

Mr Matthew Ellison, chief electrical engineer of the No. 5 (Mid-West Durham) area of the Coal Board, has died at the age of 56. Mr Ellison served for 20 years as chief electrical engineer of a colliery group and on nationalisation was appointed group engineer, later being promoted to area electrical engineer.

NEW LITERATURE

Dictionary of Electronics and Nuclear Engineering

by Robert I. Sarbacher

THERE is no question that, for relatively young sciences, electronics and nuclear engineering have accumulated an astonishing new terminology. The author of this work has produced a truly monumental volume, both in dimensions and coverage, which, the dust cover states, contains 14,000 entries, 17,000 cross references and over a million words. Without bothering to count, one can only say that every word which we looked for was there, clearly defined and frequently illustrated. The only misgiving is that, at the present rate of development and introduction of fresh terms, future editions will, in comparison with the present 4¾ lb, 2½ in. thick volume, be completely unwieldly. It will, nevertheless, find a place on the shelves of all major technical libraries where it will doubtless be frequently consulted. Sir Isaac Pitman and Sons, 1415 pages, 10 in. by 6½ in. Price £8.

The Instrument Manual

third edition, edited by J. T. Miller

SEVEN years after the appearance of the second edition, the third makes its bow. In the intervening period a tremendous amount of development in the instrumentation field has taken place, but, what is more important, many American companies have appointed agents here or opened their own British factories so that a reference work covering British production alone is hardly representative of the industry today.

Compared with the last edition, the section on navigational instruments has been dropped and the original optical section has been dispersed. New sections include one on analogue computers, but digital computers have been omitted since it was not felt that the subject could be encompassed within the space available and still be of value. Despite these shortcomings, inevitable in a reference work which is restricted to a reasonable number of pages, it remains a valuable aid to all concerned with instrumentation. Published by United Trade Press, third edition. 842 pages, 11 in. by 8¼ in. Price £5 5s.

BOOKS RECEIVED

Statistical Year-Book of the World Power Conference, No. 9, 1954-1957, ed. by F. Brown. Published by Percy Lund, Humphries and Co. Ltd., 216 pages, 10¾ in. by 8¼ in. Price 70s.

Woods Practical Guide to Fan Engineering, ed. by W. C. Osborne and C. G. Turner. Revised edition containing new section on drying, air heating and isolation of vibration and rewritten section on noise in fan systems. Published by Woods of Colchester Ltd., 290 pages, 8¼ in. by 5¼ in. Second edition, price 17s 6d.

Photoconductivity of Solids, by R. H. Bube. Claimed to be first comprehensive book on the fundamental physics of photoconductivity. Published by Chapman and Hall, 461 pages, 9 in. by 5¾ in. Price 118s.

Selected Semiconductor Circuits Handbook, ed. by S. Schwartz. Claims to present 150 circuits representing most advanced engineering techniques. Deals with product design points as well as giving circuit diagrams. Covers both communications and computer applications. Published by Chapman and Hall, 503 pages, 8¼ in. by 5¼ in. Price 96s.

Principles of Illumination, by H. Cotton. Covers fundamental principles, with IEE Part 3 examination in mind, but includes additional material for practicing illuminating engineers. Published by Chapman and Hall, 526 pages, 8½ in. by 5½ in. Price 75s.

Electromagnetic Energy Transmission and Radiation, by R. Adler *et al.* Undergraduate text-book based on Massachusetts Institute of Technology work. Published by Chapman and Hall, 628 pages, 9 in. by 5¾ in. Price 116s.

Alternating Current Machines, by H. Cotton. Concise text-book with illustrations from current practice. Published by Cleaver-Hume Press, 328 pages, 7½ in. by 4¾ in. Second edition, price 21s.

High Voltage Direct Current Power Transmission, by C. Adamson and N. G. Hingorani. Text-book by staff responsible for Manchester College of Science and Technology high-voltage laboratory covering basic principles of d.c. transmission and equipment design. Published by Garraway Ltd., 284 pages, 9¼ in. by 7¼ in. Price 84s.

Deep Freeze for Computers

NOVEL TECHNIQUES IN DEVELOPMENT PLANS

FASTER speeds in operation of electronic computers may come through micro-miniaturisation with circuit elements operating near absolute zero temperature through immersion in liquid helium. This has been predicted by Mr A. St Johnston, Joint General Manager, Elliott Bros' Data Processing Group.

At present, computers incorporating transistor circuits are achieving switching speeds an order of magnitude faster than is possible with valve circuits. Recently introduced elements can switch from one state to another in between five and ten millimicroseconds (10^{-9} sec). Such elements are based on investigations into basic physics of the semiconductor. Apart from limits arising from these considerations, the spatial arrangements of circuits in computers impose a limit, because of the finite rate of transmission of electrical impulses. For example, a 5×10^{-9} sec rise time implies that two elements 5 ft apart can each think the other has switched later than itself. Additional problems result from radiation of what are effectively 200 Mc/s radio signals inside the machine.

Mr Johnston predicts that restrictions of size accompanying use of conventional components is likely to make operating speeds such as those discussed the limit for some years to come. The corollary is that high-speed elements of the type currently available will not be rendered obsolescent in the immediate future.

Use of micro-wave techniques might help overcome the transmission problem in computer design, and there were hopes at one time that the tunnel diode might make possible conventional circuits operating with a 10^{-9} sec rise time. However, it is now thought likely to be a long time before machines using tunnel diodes are available with higher speeds than transistor machines. The physical size problem affects the tunnel diode just as much as the conventional transistor.

Future Development

Development of micro-miniaturisation and low temperatures (cryogenic techniques) will involve making use of superconductivity, with conductors having effectively zero resistance. They can then be made resistive by application of a magnetic field or by a slight increase in temperature. The cryogenic elements themselves will require very thin films of materials which are difficult to reproduce reliably; and there are many engineering problems to be solved associated with maintaining very low temperatures.

A still more advanced concept is a possible use of thin films of magnetic material consisting of a single crystal domain. Such films may be deposited in vacuum or electrolytically. They lend themselves to being etched in extremely fine patterns, possibly under control of an electron microscope. The ultimate result may be complete circuits invisible to the human eye, approaching in packing densities the storage characteristics of the human brain.

The millimicrosecond time interval mentioned so often in the discussion above is roughly the time taken for light to travel the distance of 1 ft. In a paper by Mr N. E. Wiseman, of Elliott's, in which the fundamental sources of delay in computer operation are analysed, it is said that propagation of a signal along the wires in a computer may amount to between 2×10^{-9} and 5×10^{-9} sec/ft, although in free space, as already implied, the propagation rate is about 1×10^{-9} sec/ft.

A delay of about 10×10^{-9} sec is attributable to the inherent characteristics of each transistor used in handling a signal in even the most advanced computers.

Another factor which the computer designer has to keep in mind is that the edges of the waveforms typical of his machine contain 300 Mc/s components. At very high frequencies most of the current in the conductor is, of course, carried in a very thin sheet near its surface (skin effect). Thus, one of the major problems becomes that of maintaining an acceptably low impedance in signal and d.c. routes through the computer.

At the high frequencies involved, radiation from signal wiring can introduce difficulties as well. The sort of techniques that have to be used to overcome this include use of large surface sheets for earth conductors and power supply distribution busbars; screening adjacent logic units from one another by the earth sheets and extensive decoupling of d.c. routes; and avoidance of bunched signal wires, having all wiring point-to-point.

It is understandable, with this background, that Mr Wiseman should comment: "In many ways, circuit engineering for very high speed systems is becoming a difficult art."

SMALL POWER REACTORS

MORE than 50 papers on small and medium power nuclear reactors are to be presented at a conference to be held in Vienna from 5 to 9 September. Forty countries are to be represented at the conference, which will be the first international gathering on the subject since the 1958 UN Geneva conference on the peaceful uses of atomic energy.

Organising the conference is the International Atomic Energy Agency, which has initiated a programme to encourage development of nuclear power in the less-developed countries of the world. This programme provides for surveys of nuclear power needs in such countries, and for a watch on development of suitable power reactors.

The coming conference will deal with technical aspects of nuclear reactors up to about 100 MW electrical output, including present status and future prospects of the various reactor sytsems and concepts. It will also cover cost evaluation and economics of nuclear power based on such reactors and, more generally, the role of power reactors in meeting energy needs, particularly in less-developed countries. Present estimates are that some 250 experts will be attending the conference, to be held in Vienna's new Stadthalle.

B.E.P.C. past and future

BY JOHN W. SIMPSON,* O.B.E., F.C.I.S.

SINCE the inception of the British Electrical Power Convention in 1949 much has been said for and against its continuation as a yearly event, at least in its present form. Lord Citrine, who was undoubtedly responsible for its birth, convinced the many diverse opinions that only by full co-operation and goodwill could success be achieved. The opportunity of meetings one's friends and of making new ones each year is a major factor for the continuation of the good relationships which already exist throughout the industry. These should be fostered. Now and again certain criticisms are levelled, but I have yet to hear of anything constructive which could be considered an improvement. I have myself felt for some time that something could be done to create a greater interest in the convention—the only one of its kind in the world—by widening its scope.

Re-appraisal Wanted

Before a rapidly changing industry, the similarity of the papers that have been presented over the past few years is disconcerting. Progress reports are all very well in their place, but I feel that at a convention such as this the subjects chosen should cover a much wider field and should not be confined to, say, two or three sides of the industry. The number of papers to be presented could be increased to at least six so as to give other sections of the convention an opportunity of placing before the public a record of the part they play in this great industry. I have always been a keen supporter for annual meetings of the convention, not because I was intimately connected with its organisation, but because the continuity of such meetings, organised on proper lines, is of great benefit to the individual who attends and to the industry as a whole.

I suggest the time is opportune when a re-appraisal of the format of the convention might be of value. I believe that increasing emphasis should be placed on the development side of the industry and in selecting subjects for discussion they should always have a place in the programme. Competition is always with us and the public need to be constantly reminded of the lasting benefits from electricity. Regarding the type of papers to be submitted, no-one will quarrel with the suggestion that they should possibly deal with the differing aspects of the industry. Not enough is heard about interests ouside "supply, generation and manufacture."

There should be greater cohesion in outlook between the parties and greater interest shown in the formulation of the programme for conventions. At present too much is left to too few. For instance, it might be a good thing to arrange a one-day forum primarily for those who will eventually become responsible for leading the industry in the future. Let us hear *their* views. I am convinced that a great deal of good would result.

Not all the industry is represented at the convention; membership comprises the principal electrical organisations in the country, but there are many important firms which are not members of such an organisation. It may well be, however, under the impact of current trading conditions more firms will tend to join their appropriate organisations.

It is not for me to suggest changes in the constitution of the convention. I have felt for some time that the membership of the council is liable to become unwieldy. Large committees are apt to be less effective than small ones. There may be a case for a reduction in the numbers serving on the council and also for the election of the council by ballot, one-third retiring each year. The present council consists of 27 representatives of various organisations. All the past-presidents are members although only the two immediate past-presidents have the power of voting. However, there is a good deal to be said for the present selection of members to serve on the council. It might improve the position, however, if there was a small working committee, or the present management committee adapted with a chairman of the council presiding. This would relieve the president of these duties and provide for greater continuity of thinking. This committee could deal with the selection of subjects for papers, formulation of the programme and all activities connected with the convention. Although other minor amendments may be necessary to the present rules, there is no need to alter the policy as outlined in "The Objects"—they are wide in their application.

The National Platform

With regard to publicity it seems strange that one of the most important industries in the country cannot secure good publicity for its activities—what is the reason? One is inclined to suggest that the primary cause is lack of controversial material in the papers. This is not to say that the papers are at fault, they are generally good, but they do not seem to contain the outlook and thought which attracts publicity. The time has come for a re-thinking of the type of papers to be presented.

Referring to the electrical exhibition, I am one of those who feel that the discontinuance of an exhibition in connection with the convention will not unduly affect its success. The exhibition provided an excellent opportunity for meeting friends and a focal point for the convention, but it would seem that results did not warrant the heavy expenditure incurred by the exhibitors. It was different in the former days when the electricity supply industry was in the hands of local authorities, but manufacturers have now had to face the fact that times have changed.

These few notes have given me an opportunity of airing some views on the BEPC. They are sincere and I hope the president and his council will, in considering any of the revisions of the rules, bear these points in mind. I sincerely wish the convention ever continued success.

---

* Former secretary, British Electrical Power Convention.

for the electrical trade

Continental battery shaver

A BATTERY-OPERATED shaver has been imported from the Continent and is selling here at £3 7s 6d, tax paid. This model uses three U2 batteries in a cylindrical case, the rotary motor turning the blades at 5,300 r.p.m. under a circular shim head. The new shaver, known as "Record" and guaranteed for one year, has changeable copper-carbon brushes. Batteries, it is stated, should last for up to 200 shaves. *Denvion Ltd., 10 Ansdell St, W.8.*

Bike thief alarm

A NEW burglar alarm for use on motor scooters and cycles makes use of a high frequency screaming device worked by a mercury switch. The kit, which can be assembled and installed quite easily within half an hour comprises the alarm and mercury switch, 4½ V battery, on-off switch and fixing accessories. The alarm will sound immediately the vehicle is tampered with and carry on sounding until the concealed main switch is operated. The kit sells at £3 19s 6d tax paid. *The Lander Equipment Co., 6-10 Playfair St, Glasgow, S.E.*

No glare light fittings

FALKS offer "glare-free" illumination in three of their latest domestic light fittings, a standard lamp and two table models. In each unit the ideal is approached in different ways.

The standard comprises a plain black pole on a white circular base, supporting a broad white plastics shade. Light from a 100 W lamp is reflected on to the shade by a specially designed metal top cover which also excludes upward light. Cat. L3777, £13 9s 6d tax paid. The more expensive table lamp, L3776, illustrated below, is actually a diffuser fitting. The shade, matt black on the outside, is mounted on a polished brass stand and can be rotated almost completely. Price, £9 3s 9d tax paid. Lastly comes the L3775, which uses a neatly designed cut-off shade in the same white opal plastics as its companion model. The brass stem is set at a slant from the edge of a circular stand and partly encased in a tapering walnut sleeve. Light is spread well by the cut-off shade, but can in any case be projected by swivelling the lampholder joint. It sells at £6 18s including purchase tax. *Falk, Stadelmann and Co., 91 Farringdon Rd, E.C.1.*

Falks smart diffuser table lamp, L3776, £9 3s 9d

Pep cushion

AN item being imported from Austria is a vibrating cushion claimed to have a number of health giving functions. It is a flat cushion of foam rubber, covered in brilliantly coloured plastics with a length of flex and two-point plug. It produces penetrating, but silent, vibrations said to ease tired feet, headaches and other minor ills. The cushion, "Viki," will sell at something in the region of £10. *The Rustone Trading Co., Westcombe Hse, Whitcomb St, W.C.2.*

M-R prepare for the cold

WITH the approach of autumn come no less than three new heaters from Morphy-Richards, a fan heater, an infra-red fire and a "small bedroom convector." They are all comparatively inexpensive.

The fan heater, known as "Bermuda," has a 2 kW element with safety cut-out, which can be switched down to 1 kW and a dual speed fan. Designed for wall fitting or as a free-standing unit its support is adaptable to either position, as well as allowing variation in direction of the air flow. "Bermuda" is finished in pearl bronze or charcoal with a red diaphragm, while grille, rims and spring-loaded handle, etc., are in off-white. It is about a foot square. Price £8 18s 6d tax paid.

Down the rating scale comes an infra-red fire at 750 W. It is only 3 in. in height, but with a length of 33½ in. and weighs only 4¼ lb. The reflector is adjustable, as most are these days, and its grille removes easily for cleaning. Finish: off-white with cinnamon ends, or charcoal with off-white ends. Price is noteworthy at £4 19s 6d.

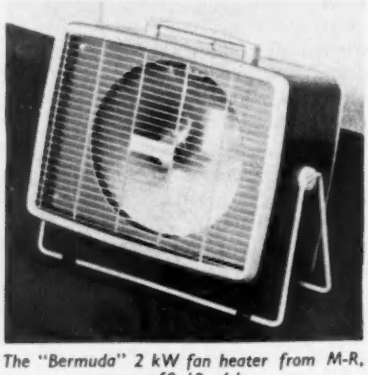
Lastly, is the "small bedroom heater" a 750 W convector, which may be wall mounted or free-standing, since both bracket and legs are provided. It is thermostatically controlled, incorporating a pilot light. It is intended, of course, for only the smallest rooms and, consequently, takes up little room being only 2 ft high and 16 in. long. Its depth is 5¼ in. Finished in blue with a pearl grille, it sells at £7 19s 4d. *Morphy-Richards Ltd., 50 Conduit St, W.1.*

Thermodare correction

In last week's issue the rating of Thermodare's Model 100 infra-red fire was incorrectly quoted as 100W. This should read 1,000 W. Also, replacement price of the elements is 15s and not 1s as stated.

Wall-plug grips

THE ordinary wall-plug and screw anchor have seen a number of variations recently, one being the "Grippoplug." This device consists of a tapered brass collet which fits into the bottom of an expanding shell and provides a firm grip for the screw on the inner material of the wall without it exerting a crumbling force on the outer plaster. Most types of wall are within its scope, including stone and granite. Two inchers are available with plugs of four sizes ranging from 8s to 8s 9d/set per dozen; washers are included. *Grippo Products, Henshaw Wks, Oldham, Lancs.*



The "Bermuda" 2 kW fan heater from M-R, £8 18s 6d

TRADE PUBLICATIONS

LDEP.—Leaflet D2201102 Transistorised level control series TLC 1 and 2; D6111-01, electronic process timer series PCT 1 and E 1631-01 automatic lighting control unit series ALC 3 from Lancashire Dynamo Electronic Products, Rugeley, Staffs.

GEC.—Two technical leaflets; Vacuum Induction furnaces and Vacuum Resistor Furnaces. From The General Electric Co., Erith, Kent.

GEC.—Technical descriptive leaflet No. 379, of "Witton-Kramer" Electric Lifting machnets. General Electric Co., Magnet Hse, Kingsway, W.C.2.

SQUARE D.—Temporary catalogue, January 1959, No. 4 of Electrical Control gear. 57 pages illustrated. Square D Ltd., Swindon, Wilts.

BAILEY.—10-page illustrated brochure on Bailetronic Process Control from Bailey Meters and Controls, Purley Way, Croydon.

equipment for industry

Capacitance level controllers

TWO capacitance sensitive monitors, although primarily intended for level control in tanks, silos and hoppers, are also suitable for a variety of other applications. Both controllers incorporate a crystal oscillator with temperature and mains compensation and may be used with lead length of up to 100 yd. The "Contimitor" uses a matched transmission line to connect the instrument to its probe and is intended for continuous level indication. Sensitivity is claimed as sufficient to give a 1 mA change in output signal for a 10 pica-farad capacity change or even only 0·03 pica-farad where extreme sensitivity is required. Alternatively, an output of 5 V can be used as the input to a d.c. amplifier. As well as continuous level measurement the "Contimitor" can be used to measure thickness of paper and plastics. High and low level control of liquids and solids can be effected with the second instrument, the "Proximitor." This device can also be used for batch counting on conveyors at speeds up to 12,000/min. Both these controllers are housed in robust cast aluminium cases suitable for withstanding heavy industrial use. *Electronic Machine Co. Ltd., Mayday Rd, Thornton Heath, Surrey.*

Polyester capacitors

ADVANTAGES claimed for a series of polyester capacitors now available are: operation up to temperatures of 100°C, a high insulation resistance, and good performance under climatic tests. The capacitors are housed in a polyester "Polycap" clearly labelled to indicate rating and with tinned soldering tails. The range is offered as an alter native to normal paper dielectrics and is claimed to be reasonably cheap. Capacitors are available from 0·01 to 0·05 micro-farad ±20%, 350 V d.c. working. Overall dimensions are 28 mm long by 7-12 mm diameter. The insulation resistance is greater than 100,000 megohms and power factor at 25°C less than 0·01. *Suflex Ltd., Bilton Hse, 54 Uxbridge Rd, Ealing, W.5.*

100 A terminal block

A FURTHER addition to an extensive range of accessories made by Metway is the 100 A two-way terminal block illustrated right. The blocks have substantial inserts moulded into a plastics shroud. They can be supplied in multiple units of two blocks mounted on galvanised metal rails with from 2 to 58 ways. The blocks are also available without the metal mounting rail. *Metway Electrical Industries Ltd., Metway Wks, Canning St, Brighton 7.*

Differential pressure controller

THE range of 4 in. pressure and temperature controllers recently introduced by Tomey Industries has now been supplemented by two further controllers. The first responds to working pressures from 0 to 5,000 lb/sq in. and incorporates an SPDT snap-action microswitch. The switch contacts are rated for 15 A 240 V a.c. and, if required, a dual switching arrangement can be fitted. The second introduction is a miniature switch, only 2 in. in diameter, sensitive to pressure and temperature. This switch has contacts rated for 10 A at 240 V a.c. for use on pressure and temperature ranges from 0 to 1,000 lb/sq in. and 60 to 500°F. The corresponding differentials are ±4 lb/sq in. and ±4°F. *Tomey Industries Ltd., Catherine St, Aston, Birmingham 6.*

Industrial fluorescent fitting

THE well-known range of industrial lighting fittings manufactured by Heyes of Wigan has now been supplemented by an attractive fitting for dual miniature fluorescent tubes. The "Fluolacent," Type 1316, fitting has an opal Perspex cover hinged at one end and retained by a single fixing screw to facilitate lamp changing. A rubber seal prevents dust access to the aluminium baseplate. Two 21 in. 13 W tubes are mounted on a steel plate in the aluminium base of the unit, which also houses the control gear. Overall dimensions of the fitting are 2 ft 3 in. by 5⅞ in. by 3¾ in. deep and it has a silver hammer enamel finish. *Heyes and Co. Ltd., Wigan.*

More efficient pumping

IMPROVED hydraulic efficiencies resulting in pumping losses being reduced as much as 20% have been obtained in a range of pumps recently announced. These mixed flow submersible pumps are intended for deep-well working with submersible motors. In many cases it has been possible to reduce the number of pump stages with the improved design techniques used. In addition to the saving in cost of power consumed, during redesign of the pumps, the opportunity was also taken to simplify the pump construction. *Stone-Chance Ltd., 28 St. James's Sq, S.W.1.*

Silicone rubber price reductions

IMPROVED manufacturing facilities and increases in bulk production have enabled the prices of many of the Silastomer series of silicone rubbers to be reduced in price by as much as 10%. The Silastomer rubbers included are numbers 50, 80, 122, 125, 152, 156, 160, 181 and 6-126, reductions on certain other grades have also been possible. *Midland Silicones Ltd., 68 Knightsbridge, S.W.1.*

Overhead lamp maintenance

BY adapting their "Tallescope" light aluminium telescopic work platform to the well-known "Harbilt" electric truck, Access Equipment have developed a light, compact maintenance vehicle suitable for periodic inspection of overhead fluorescent lamp fittings. The Talles-

Miniature "Fluolacent" fitting by Heyes encloses two 13 W fluorescent tubes

This 100 A 2-way terminal block by Metway can be supplied in multiple assemblies mounted on galvanised metal rails

Efficient maintainance of street lighting by an adaptation of the Access Equipment aluminium telescopic work platform mounted on a 'Harbilt' electric truck

cope extends to a height of 26 ft and can be closed down to a height of only 6 ft 6 in. to pass through doorways. The "Harbilt" truck has a speed of 10 to 12 m.p.h. and range of up to 30 miles. *Access Equipment Ltd., Maylands Ave, Hemel Hempstead, Herts.*

Miniature electronic process timer

THE range of electronic timers manufactured by Elcontrol has recently been supplemented by a miniature timer giving high repetitive accuracy at a considerably lower cost than earlier models. These timers are claimed to be suitable for resistance welding control, life testing machine sequence control and a variety of other industrial processes. They are housed in a steel case 7½ in. by 6 in. by 5½ in. and are available in three timing ranges up to 5 min. A feature claimed for the timer is its high repetitive accuracy of better than ±1%, with normal mains variations. A range of delay switches is also available with timing ranges varying from 1·5 to 300 sec and with an accuracy claimed as better than ±1%. These switches have one normally open and one normally closed contact rated for 5 A to 50 V and similar contacts for 250 mA to 250 V. These delay switches are also housed in steel cases with overall dimensions of 7½ in. by 6 in. by 5½ in. Delay switches remain energised until the end of the desired time interval when power is initially supplied to them. Each switch has an uncalibrated dial marked in ten divisions.

Another recent introduction is a flame failure and ignition controller for the high velocity air blast tunnel burners recently developed by the West Midlands Gas Board. The control unit operates in conjunction with a flame failure infra-red detector and incorporates timing sequences to ensure adequate purging and safe operation. *Elcontrol Ltd., Wilbury Way, Hitchin, Herts.*

Measuring liquid flow

AN ingenious instrument designed for measuring water flow to turbines is also suitable for flow measurement on many industrial fluids, fuels, alkalis and certain acids. The flow meter consists of a non-magnetic housing containing a magnetic, stainless-steel bladed rotor. A magnetic pick-up coil, fitted outside the housing, senses the rotor blade rotation, giving an output signal whose frequency is proportional to the volumetric flow rate. These flow meters are available for flows from 0·25 to 10,000 galls/min. Their accuracy is ±0·5% over a 10:1 flow range and is claimed to be little affected by variations in viscosity. Their simple, rugged construction enables them to be used for pressures up to 2,000 lb/sq in. and temperatures from −200°C to 500°C.

To convert the frequency impulses to an electrical signal, the company's frequency converter, EF 1004, is available and there is also a range of five moving coil meters for panel indication. For recording total flow, an electronic scaler is also available which displays the flow on "Digitron" number tubes.

Another recent introduction is a compact miniature potentiometric recorder occupying a panel space only 7⅞ in. by 5½ in., yet with high accuracy and adaptability. The recorder has six chart speeds and six standard ranges available from 1 to 100 mV. Accuracy is ±0·5% or ±10 mV, whichever is the greater, and its sensitivity is 0·1% or 5 mV. The recorder has a suppressed zero which may be varied from 10 to 20 mV and facilities for an output shaft drive to pneumatic or electronic controllers. These instruments are available from *Firth Cleveland Instruments Ltd., Stornoway Hse, Cleveland Row, St. James's, S.W.1.*

Fast vertical welding

ADVANCE information on a new fast welding technique, now undergoing extensive field trials, has been released by Rockweld. The technique is claimed to give high-quality welds with perfect radiographs when welding relatively thin sheets of metal at high speeds. Known as the Comatic process, it is applicable to vertical metal sheets in mild and low alloy steels with thicknesses down to ¼ in. In principle, the Comatic process consists of melting both the wire and the parent plate under a blanket of CO_2 gas. The molten metal is contained by water-cooled copper shoes which move vertically up the joint. These shoes are mounted on a carriage, which also houses controls and meters, and which runs up a vertical frame supported against the structure to be welded. High operating speeds are claimed for the new technique, for example, when welding ¾ in. thick plate a speed of 15 ft/hr is possible. *Rockweld Ltd., Commerce Way, Croydon, Surrey.*

Quicker Copper plating

REFINEMENT of a well-established technique, that interruption of current leads to a higher quality deposit in copper plating and improved cathode efficiency, is enabling copper-plating times to be nearly halved. A suitable unit for interrupting currents from 1 kA to 2 kA has recently been introduced. The unit is connected integral with either the positive or negative busbar feeding the plating tank and incorporates a built-in timer and a main contactor. Controls which permit current to be continuously on, or periodically interrupted are provided with a pilot light indicating when current is flowing. The standard cycle is 8 sec on and 2 sec off and tests have shown that a deposit of 0·001 in. copper is obtainable in 17 min. with this cycle as against 30 min. with a continuous current of 20 A/sq ft. The interrupter enables current density to be increased two-fold without risk of excessive anode polarisation or burning. *Canning and Co., Great Hampton St, Birmingham 18.*

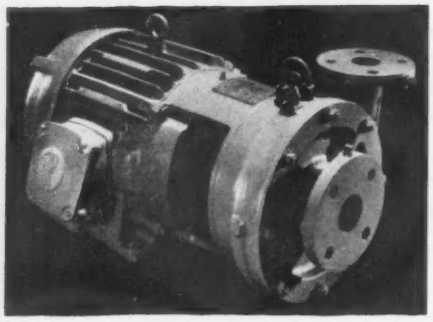
Very pure water

FOR laboratory and workshop applications, a portable water softener is now available with a capacity up to 12 gall/hr. The "Deminrolit," Mark 6, is claimed to give demineralised water with a conductivity of less than 10^{-6} mho/cm. *The Permutit Co. Ltd., Permutit Hse, Gunnersbury Ave, W.4.*

Centrifugal pumps

AN entirely new range of single-stage centrifugal pumps has been introduced in sizes from 1 in. to 5 in. Known as the Alcon Thames range, the pumps are integrally mounted with a t.e.f.c. electric motor insulated to class E. The pump casing is cast in close-grained iron and may have either a horizontal or vertical discharge. Standard impellers are of gunmetal, hand-finished and balanced. For the smallest size of pump, either a single- or three-phase motor may be used, but three-phase units are recommended for the larger sizes. Typical outputs for the pumps range from 25 gall/min with a head of 75 ft for the 1 in. to 1½ in. pump, to 500 gall/min with a head of 300 ft for the 4 in. to 5 in. pump. These centrifugal pumps may, alternatively, be driven by petrol or diesel engines. *Arthur Lyon and Co. (Engineers) Ltd., 6 Carlos Pl, Grosvenor Sq, W.1.*

The Firth Cleveland flow meter has a permanent magnet rotor and external pick-up sensing rotational frequency of impeller which is proportional to flow



Recent introduction by A. Lyon is a range of single-stage centrifugal pumps mounted on the end shields of t.e.f.c. motors. The Alcon Thames range is also suitable for driving by petrol or diesel engines

PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

Hungry Fluorescent

IN the village to which I retire after my day's work there is a small off-licence and general shop. Recently I noticed that the proprietor had installed fluorescent lighting and he was very proud of the fact until, one night, he asked me if he could have a chat with me after hours. Back in my home that evening I listened with interest to his tale of woe. Since the lights had been installed, his electricity bill had almost doubled, but, as he had been led to believe that the lighting was much cheaper to run, he had been leaving it on for a little longer each evening but certainly not more than a few hours each week.

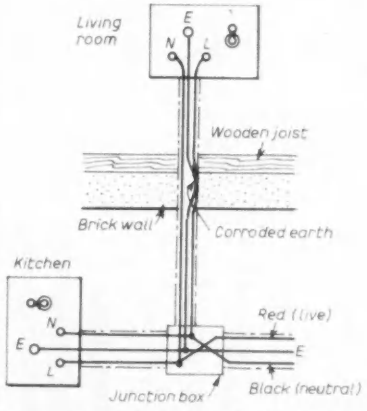
I took along my meter and checked the consumption of the fittings which were using 80 W tubes. The consumption was nearly 150 W per fitting. A further examination showed that the ballast on the top of the fitting was of the resistive type and was throwing out heat like a small radiator. Now clearly here was a case where a shopkeeper had been sold fittings which were, at the best, designed for d.c. and not a.c. supplies but were not even equipped with lamp ballasts which contribute to the light output of the fitting. It is possible that they were old, reconditioned units, but, in any case, he had most definitely been "sold a pup."

Incidentally, I wonder how many domestic and commercial users realise that the so-called 40 W and 80 W tubes really consume about 50 W and 90 W when one takes into consideration the ballast losses? Is not the practice of calling these units by the consumption of the tube alone rather unfair to the consumer?—*F. R. Ralph.*

Crafty Maintenance

WHILST carrying out a periodical test and inspection in domestic premises, I came across an interesting piece of what I can only describe as "crafty maintenance" and I feel that this will be of interest as an example of the sort of thing which can occur in practice. During the course of the inspection I happened to notice that a red cable was connected to a neutral terminal in a distribution box. This box served as a supply to a switched socket-outlet in the kitchen and another in the living room. Disconnecting the cables and testing, I soon discovered, as I anticipated, that the outgoing "live" cables were down to earth, but that the neutral cables showed good insulation resistance. Further investigation disclosed that the cables from the box to the living room passed, in slip conduit, through a joist and wall and that, as a result of excessive corrosion, the "live" cable, earth wire and conduit had welded together at the point where the conduit entered the wall.

What had happened now became obvious. Faced with a fault on the live cable, but with a sound neutral, some electrician had hit upon the palliative of transposing the incoming feeds to the box so as to get things going. Certainly, it did get supply back to the points again, but now both socket-outlets were switched on the neutral side, a most dangerous state of affairs which is contrary to the IEE regulations. Naturally enough, I pulled out the whole of the faulty wiring and conduit and replaced it in the proper manner.



Transposition of the feeds to a junction box may be a way of overcoming a fault on a live line but it is a practice to be condemned

I do not, of course, know who was responsible for the piece of "crafty maintenance" or I would certainly have shown him the error of his ways, but even supposing that it had been an evening emergency repair—and such cases can be justified on occasions—to allow it to persist for more than a few days at the most is to court the greater risks of fire and dangerous shock, and showed a lack of responsibility on the part of the man concerned.—*J. H. Robinson.*

Inverted Towel Rail

ABOUT 18 months ago, when my landlord was converting our flats from central heating and water systems to individual electrically heated systems as part of the conversion, he installed, or caused to be installed, Hurseal towel rails in the bathroom. The work was carried out by local electrical contractors of established reputation.

Now it so happens that this particular unit is only made for a bottom right-hand connection and the instructions clearly state that the towel rail must *not* be installed upside down since it will leave the heating element exposed in the enclosed air-space which is there to allow for expansion of the oil. Despite this, since the block of flats comprises right- and left-handed pairs, the contractors installed half of the radiators upside down. Fortunately, my flat happened to be one in which the unit was installed this way and, as I was aware of this point, I insisted that they make arrangements to connect it right way up. After much grumbling they did so, but it was only when I warned the tenants of other flats about this that they all checked their own installations and made similar complaints. I wonder how many of these towel rails in the country are incorrectly installed and whether the so-called "do-it-yourself" man would have made the same error?—*Ion.*

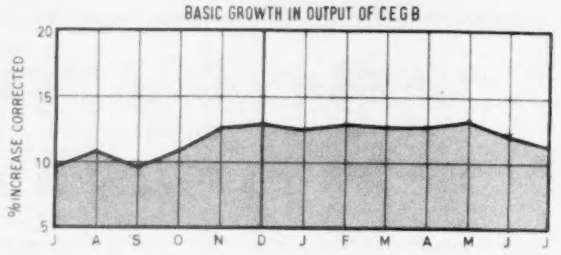
Shocks from Dead Cables

IT is not always safe to assume that long lengths of underground p.i.l.c. or similar cable are safe to handle just because they are "dead," that is, disconnected from a source of supply. The static charges which can accumulate on them can give a very nasty shock as a jointer in my cable laying gang discovered some time ago. The cables in question were three 1 sq in. single core armoured cables laid between a transformer and a distribution bus which were about 800 yd apart. They had been laid the previous day and were capped at each end. The capping was removed before the lunch break at one end and, after the break, the jointer got down to exposing the cores.

As soon as he touched the conductor of the first cable he experienced a severe shock and reported that the cable was alive. Called to the scene I soon showed him that the charge was a static one by earthing the conductor and then handling it with safety. As most mains engineers are aware, the full insulation test with a megger is to charge up the cable until the needle shows infinity and then to leave it for half an hour before discharging. If a healthy spark does not result, then the cable is suspect regardless of a healthy reading on the megger. —*T. Lambert.*

POWER SUPPLY

Statistics for July



ONCE again, July has been a sparse month for commissioning and, as for June, we record only one new installation. None the less important for being solitary, it is the first 120 MW set at the new Staythorpe "B" station. This set, the first of three to be installed, was built by AEI (Metrovick) and is supplied with steam from an 860 klb/hr John Brown boiler.

No new plant was brought into service by either of the Scottish boards in July, but decommissioning of the Falkirk station was completed with the shutting down of three sets, totalling 7·5 MW installed capacity, by the SSEB.

An unexpected aspect of this month's figures is the high level of electricity generated, which, at 7,770 million units, is only slightly less than for June instead of following the downward trend usually obtained at this time of the year. The total for the three boards is 11·4% higher than in July last year and includes 7,282 million units generated by the CEGB, and 131 and 357 million units generated by the NSHEB and SSEB, respectively. The total electricity sent out by the three boards totalled 7,292 million units.

An increase in generating plant output capacity of 6·6% is recorded over July last year. The CEGB had 25,753 MW of plant in service, and the two Scottish boards' figures, which have remained almost unchanged since the beginning of the year, were 1,043 for the NSHEB and 1,651 MW for the SSEB.

Increase in the national figures for units sold was 12·6% during July reflecting the poor weather conditions. When corrected for average temperature and number of working days, this figure becomes 11·2% and is more in line with the year's trend. Marked increases in units sent out were shown by area boards in the South of England, especially a 22·7% increase by the Southern Board.

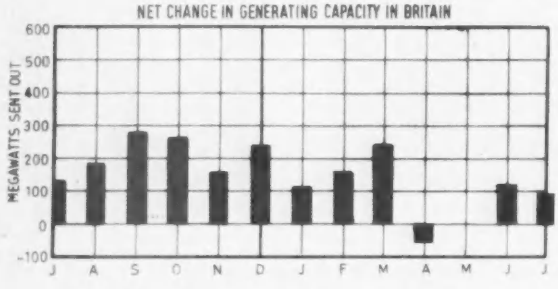
Total industrial generation during the first half of 1960 was 6,746·1 million units or 19·7% higher than for the same period last year. Generation was fairly evenly divided between the three major industries—paper, chemicals and iron and steel. To the chemical industry must, however, be added nuclear generation, which, at 961 million units, was 91% higher than in the first six months of 1959.

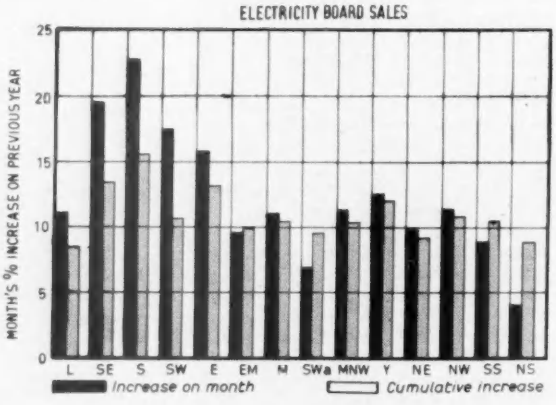
Excluding nuclear power production, there has been a rise in industrial generation during the first six months of the year by 12·8% compared with 1959. Generation by transport undertakings fell by 2% to 484·7 million units.

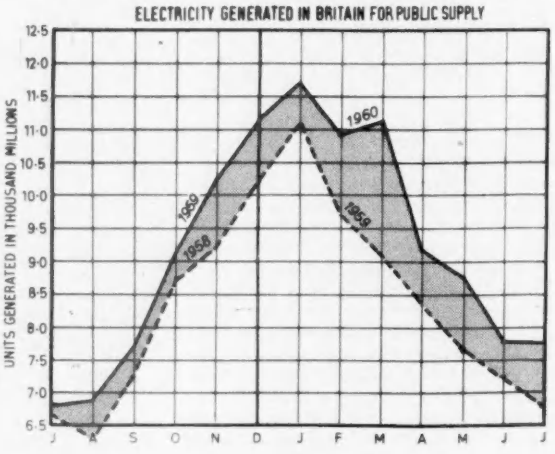
Electricity Board Sales Progress in July

Board	Electricity sent out in millions of units	% increase on July 1959
London	507·3	11·0
South Eastern	409·9	19·4
Southern	548·4	22·7
South Western	270·8	17·3
Eastern	636·2	15·7
East Midlands	548·2	9·7
Midlands	704·3	11·0
South Wales	443·2	6·9
Merseyside and N. Wales	456·6	11·2
Yorkshire	722·5	12·6
North Eastern	415·8	9·9
North Western	707·5	11·3
Direct Supplies by CEGB	316·2	7·9
CEGB Total	6,686·9	12·6
South of Scotland	458·7	8·8
North of Scotland	109·8	4·1

Table excludes area board purchases from other sources







News of the Week

CONTRACTING WORKING WEEK CUT TO 42 HOURS

Co-operation to reduce time wasting

FROM 1 November next the standard working week in the electrical contracting industry will be 42 hr, instead of 44. Individual employers will decide what hours shall be worked each day. The agreement between the NFEA, representing the employers, and the ETU pledges them to work for full utilisation of hours of work and elimination of time-wasting.

The working week reduction is being effected by a change in hourly rates which give approximate recognition to the principle that the cut in hours shall be accompanied by no change in pay. Effectively, there is an increase of 3d/hr for journeymen electricians. For them, and other grades, rates of pay inclusive of cost of living addition are shown in full in the table set out below.

Wording of the agreement on time wasting is that both parties to the agreement pledge their full co-operation at national, area and site levels to secure (a) full utilisation of hours of work, which shall not be subject to unauthorised "breaks." Time permitted for tea breaks shall not be exceeded. (b) The achievement of maximum output and the elimination of all forms of time wasting. To that end there shall be strict adherence to starting and stopping times and to meal breaks.

The new 42-hour week may be worked over 5 or 5½ days at the discretion of the employer, but for a 5-day week the daily limits are 7.30 a.m. and 6.30 p.m. and for a 5½-day week, 7.30 a.m. and 6 p.m., with not more than 4 hr before 1 p.m. on Sundays. One break of not more than 1 hr is to be allowed for meals on days other than Saturday.

Journeymen		Adult Mates	
Grade "A" area	5s 6½d	London	4s 7d
Mersey District	5s 5d	Mersey	4s 6d
Grade "B" areas	5s 2d	Elsewhere ...	4s 3½d

Category I and II Apprentices			
Age	Grades		Mersey District
	A	B	
15	1/1½d	1/0½d	1/1d
16	1/4½d	1/3½d	1/4½d
17	1/8d	1/6½d	1/7½d
18	2/6d	2/4d	2/5½d
19	3/4d	3/1d	3/3d
20	4/0d	3/9d	3/11d

Gresham Group Reorganise

GRESHAM-LION Electronics Ltd. is the name adopted by a new company formed by the amalgamation of Gresham Developments Ltd., of Hanworth, Middx, and Lion Electronic Developments Ltd., of Feltham, Middx. The new concern will operate from Gresham Hse, Twickenham Rd, Hanworth, Middx. Its directors are Messrs J. P. Coleman, J. A. Clegg and Dr C. B. Speedy. The reorganisation has been undertaken to eliminate overlapping interests and facilitate closer co-operation between research, development and production functions.

Hartley Electromotives Deal

ALL the capital of Hartley Electromotives Ltd., of Shrewsbury, has been acquired by James Austin and Sons (Holdings) Ltd., cordage manufacturers, for £218,300. Of that amount £139,300 was paid last week and the balance is to be paid in three equal yearly instalments on 30 June, 1961, 1962 and 1963. Hartley Electromotives, who manufacture the "Octopus" prefabricated wiring systems, dictating machines, electronic equipment and other electrical products, have been a subsidiary in the Hartley Baird group—itself a member of the Camp Bird organisation, which also resently disposed of its J. Langham Thompson interests.

Under the acquisition, Austins also take over two wholly owned subsidiaries, Hartley Electromotives (East Africa) Ltd. and Hartley Robertson Ltd., but another subsidiary, Hartley Installations Ltd., is not involved in the deal.

Contracting Amalgamation . . .

TWO Metal Industries group companies, Malcolm and Allan (London) Ltd. and Cable Jointers Ltd., have amalgamated in single management, operating from 229 High St, Acton, W.3. Mr E. J. Daws is managing director of the two companies, which are retaining their names and activities. Between them they cover the whole field of electrical contracts, cable jointing, wiring, o.h. lines and general industrial schemes. Object of the integration is broadening of the activities of the two concerns, with development to the point of establishing branches in the provinces.

. . . and Take Over

The Bournemouth electrical contracting concern, Aish and Co. Ltd., is being acquired by J. J. Allen Ltd., the house furnishers and departmental stores. The sum involved in the deal is about £217,000. Allen's are purchasing 4,500 £1 Preference shares in Aish for cash at par, and the Ordinary shareholders will get 250,000 new Ordinary shares in J. J. Allen. The business of Aish and Co. is to continue under its existing management, it is stated. The business was started by Mr Norman Aish, a past-president of the ECA, in 1913.

Strike dispute goes to arbitration

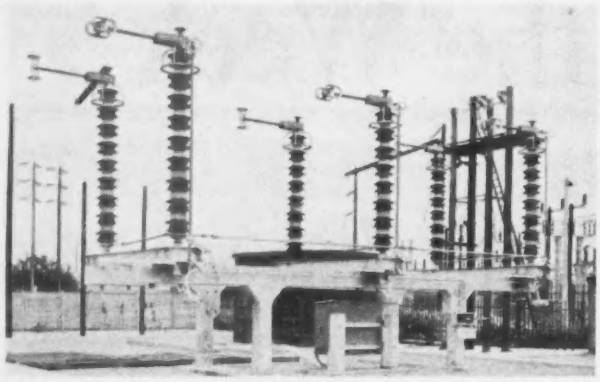
AFTER a 14-week strike of electricians at factories in St. Helens, concerned with an increase in pay for electricians, manufacturers concerned and the ETU have agreed to submit a claim to arbitration. Pending the award, work is being resumed at the factories.

U.K. Electrical Exports up

EXPORTS of domestic electrical appliances from the UK were as much as 17½% higher in the first half of 1960 than in the same period last year. This figure is based on provisional estimates made by BEAMA, who put the value of exports in the domestic field at £2½ million. Total electrical and allied exports are estimated at £150 million (more than £5 million greater than for 1959).

10% of all the industry's exports were sold to ECM countries, 7% to EFTA and about 60% to Commonwealth countries, leaving 23% for other countries. (As disclosed by *Meteor* last week.)

Additional sales of washing machines were largely responsible for the jump in domestic exports; they were about half as much again in value as a year ago. Sales of refrigerators were slightly up and there were increases in vacuum cleaners and other portable appliances and in cooking and heating equipment.



The complete 275 kV isolator seen here is undergoing mechanical tests at the works of Switchgear and Equipment Ltd., Banbury. 12 such isolators are being supplied to the South of Scotland EB under a £¼ million order, the first being due for delivery in December

Area Board Appliance Sales

ALTHOUGH sales of most domestic appliances through area boards were down in June, compared with the same month in 1959, refrigerators provided a bright exception. The June upswing in sales of refrigerators compares with a 13·4% drop in May, 1960, in relation to May, 1959.

Appliance Sales by Area Boards	Sales in month ended 30 June, 1960		Sales in 12 months ended 30 June, 1960	
	Total	% change over June 1959	Total	% change over previous 12 months
Cookers ...	25,589	−12·8	340,054	+ 8·6
Water Heaters:				
Immersion	30,924	+ 0·7	193,783	+ 8·2
Storage ...	5,425	−10·8	66,261	+18·0
Washboilers	4,487	−22·0	62,031	−17·1
Washing Machines ...	6,800	−50·0	145,290	− 2·3
Refrigerators	29,813	+13·4	167,937	+32·1

When assessing the figures it must be borne in mind that the sales by Area Boards represent only a part of the total sales throughout the country.

Rail Conference Welcome

THE part played by British manufacturers and engineers in the development of railways in overseas countries is to be discussed in a recorded broadcast talk by Lord Chandos in connection with the British Railways' Electrification Conference, which is to open on 3 Oct., 1960. He will welcome to the Conference 200 railway engineers from abroad.

Plant for British Guiana

A CONSORTIUM headed by AEI and including International Combustion Ltd. and Taylor Woodrow will supply plant for extension to the power station in British Guiana, when this is purchased by Dr Jagan's Government there. By agreements recently concluded, the British Guiana Government is to purchase the Demerara Electric Co. as a going concern from the International Power Co. of Canada. Arrangements have been made for extended payment terms. The British consortium is to supply and install up to 3 MW of additional diesel plant and 20 MW of steam generating plant, together with associated distribution equipment.

Mechanical Handling in 1962

DATE for the next Mechanical Handling Exhibition has been fixed as 8-18 May, 1962. As usual this exhibition, the eighth in the biennial series, will be held at Earls Court.

Step-up in Solar Possibilities

MOST techniques for utilising the energy in solar radiation are inefficient compared with normal engineering processes. Something better may be hoped for from a scheme attributed to Dr H. Taylor, of Israel's National Physical Laboratory.

His idea is to use a pool of water to which chemical salts have been added so that there is no tendency for the lower layers of water to rise to the surface, even when they are hotter than the surface layers. Provided the bottom layer can be kept undisturbed, it is claimed that it will get gradually hotter when exposed to solar radiation for some time.

The heat would have to be abstracted from the stagnant layer to be useful, but it has been calculated that allowing reasonable efficiency for this, an output of 6 MW from 1 sq km of pool surface might be possible.

S.W.E.B. near three-quarter million mark

CONNECTION of the 750,000th consumer in the area of the South Western EB is expected within the next week. The Board proposes some special presentation for the consumer who brings their total customers to this number. On average, about 90 new consumers are connected by the Board on every working day.

ELECTRICAL ROCKET POWER

ELECTRICAL techniques for rocket propulsion have been discussed by US speakers at an International Astronautical Conference in Stockholm. An official of the US National Aeronautic and Space Administration is reported to have predicted that the first space vehicles to be propelled by electrical rocket engines will probably be in operation by 1964 to 1965.

Electrical methods might give smaller acceleration than conventional chemical techniques, but they were expected to have much longer life. Another type of rocket discussed uses an electric arc to heat and expand gas which provides the thrust for the rocket.

Olympic tickets for dealers

NINE parties of Hoover dealers and their wives will fly to Rome during the Olympic Games as guests of the company. They are the winners in a contest based on Hoovermatic sales, judged against quota based on individual sales potential. Dealers in each of the 12 Hoover UK branches were divided into four groups according to their sales potentialities. A three-day trip to Rome was awarded to the leader in each group. A similar contest was run for Hoover's own sales people in the UK and an equivalent contest took place on the Continent. Altogether 560 dealers and their companions will fly from the UK under the scheme.

Noisy Generation

DOUGLAS, IoM, Town Council discussed alleged noisiness with diesel generators at the Pulrose power station recently when they considered purchase of a further 2,200 kW diesel generator. Chairman of the electricity committee, Alderman R. F. Quale, said that attempts were being made to reduce noise in the existing station.

OFFICIAL PUBLICATIONS

Coal: The Price Structure. Fourth edition of FBI handbook. Published by FBI Print and Publications. Price 2s 6d.

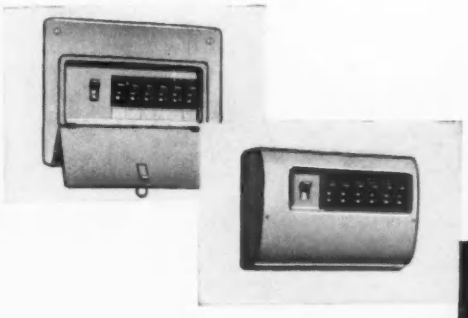
British Standards. BS 1840: Steel columns for street lighting. 4s; BS 3255; Presspaper for electrical purposes. 6s; BS 3258: Silicone-rubber-insulated cables and flexible cords. 5s.

Training Boys in Industry—The Non-Apprentice. Published by Industrial Training Council. Price 1s 9d (see page 293).

C-50

- Built-in inverse current time delay device prevents harmless transient overloads causing nuisance tripping.
- Instantaneous tripping under heavy overload or short-circuit fault conditions.
- Magnetic-hydraulic tripping ensures close and accurate protection against any form of sustained overloading.
- Neither minimum tripping current nor nominal current rating are affected by variations in ambient temperature.
- All ratings will maintain their accurate tripping characteristic after repeatedly clearing overload or short-circuit faults.
- In addition to the all-insulated consumer's unit a wide range of sheet-metal enclosures for both industrial and domestic installations will be available.

Further technical information is available on request



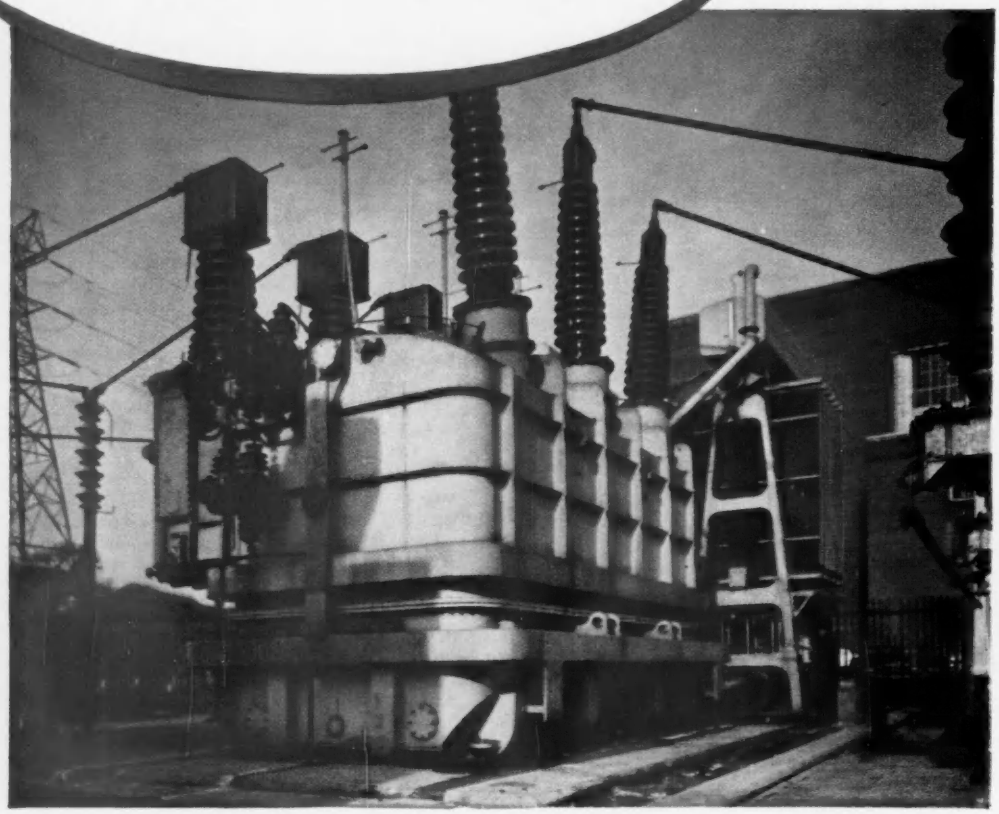
Tests have shown the new Type C-50 circuit breaker to have an unusually reliable performance. After clearing onerous short-circuit faults, the breaker will continue to function with immaculate efficiency. It will go on giving this reliable service even after fault currents have been repeatedly applied. Here, indeed, is a domestic circuit breaker you can install with complete confidence that it will not let you down.

CRABTREE

C. 803

J. A. CRABTREE & CO. LTD

GRID linked to SUPER GRID



The first 180 MVA, 3 phase, 132/275 kV auto-transformer to be completed for the Central Electricity Generating Board.

Illustration shows the first of two of these transformers at the Skelton Grange Substation of the Yorkshire Division of the C.E.G.B.

The transformers, each fitted with resistor transition on-load tap changers, were manufactured at the AEI Rugby Transformer Works.

For further details write to AEI Transformer Division, Southmoor Road, Wythenshawe, Manchester 23 or your local AEI office.

AEI

Transformer Division
Manchester and Rugby
Associated Electrical Industries Limited

E/A002

RoSPA plans Safety Week

NATIONAL Industrial Safety Week, to be organised by the Royal Society for the Prevention of Accidents from 26 Sept. to 1 Oct. is to have as its central theme Good Housekeeping in Factories —Operation Clean Sweep. Tripping, slipping, bumping and falling, combined with the use of hand tools, account for almost 70% of accidents occurring in industrial premises. To back the campaign, RoSPA are distributing posters concentrating on a figure "Jack Tidy" with the motto "Keep it Ship-shape, Mate!"

Technical Courses

SPECIAL courses for advanced students organised by Hendon Technical College for the session 1960-61 will include lecture series on transistors and their applications; on applications of radio-isotopes in industry; and on modern magnetic materials. In general, the courses are suitable for graduates or holders of HNC. Further details can be obtained from the Head of the Engineering Department, Hendon Technical College, The Burroughs, N.W.4.

Electrical Engineers' Exhibition Progress

OVER 30 new exhibitors have requested space in the 1961 Electrical Engineers' Exhibition to be held from 21-25 March. The provisional bookings so far exceed 460. The annual ballot for stand site selection is to take place at Caxton Hall on 4 Oct. Special feature of the 1961 show will be signalling and communication, with attention given to railway developments.

E.C.A. Evidence on Consumer Protection

ELECTRICAL Contractors' Association's evidence to the Molony Committee on consumer protection concentrated on appliances and amateur workmanship from the safety aspect. In the appliance section they mention, especially, cheap heaters with over-rated flexible cords, poorly plated reflectors and sheet-steel cases with sharp edges which are a danger to the user.

In addition, hot plates and toasters obtainable in some multiple stores were condemned as equally undesirable and the Association supported warnings on colour coding of flexibles attached to imported appliances.

On the amateur workmanship aspect of safety the ECA suggested to the Molony Committee that the dangers inherent in handyman wiring would be reduced if accessories were less freely available to the public.

They also criticised articles published from time to time urging the home handyman to make a variety of types of electrical apparatus. The Association told the Committee they thought that, even if efforts to eradicate poorly made apparatus were successful, the number of fatalities from electrical accidents would continue to rise unless some means were found to discourage members of the public from undertaking electrical work for which they were unqualified.

N.I. site costs criticism

EXPENDITURE of £37,000 on investigation of a possible site for a nuclear station has been criticised by the Select Committee of Public Accounts of the Northern Ireland parliament. The money was spent by the Ministry of Commerce on site investigation and consultants' fees and the site was afterwards considered unsuitable. In voicing their criticism the committee speak of a need for constant exercise of a high degree of skill and judgment in definition of objects and planning of works.

Instrument Components Change

VARIOUS instrument components manufactured by Kelvin and Hughes are now being marketed by the Industrial Division of S. Smith and Sons (England) Ltd. The change is said to be of a formal nature, by way of rationalisation in marketing arrangements, and it will not affect design. Amongst components involved are instrument motors, potentiometers, pressure devices, miniature slip-rings, magnetic recording heads and damping units, acceleration transducers, and magnetostriction transducers.

People and Machines

THE Minister of Labour, The Rt Hon John Hare, O.B.E., M.P., is to open at Harrogate, the National Conference of the Institute of Personnel Management, lasting from 7-9 Oct., this year's theme being the development of industrial relations. Following the a.g.m. and sectional meetings concerned with topics relating to personnel management, a highlight of the proceedings should be a talk to be given by Sir Ben Lockspeiser, K.C.B., F.R.S., entitled "Machines and People."

Evolution of Instrumentation

PROFESSOR A. Porter, formerly of Imperial College and now at the University of Saskatchewan, is to deliver the first Ultra Anniversary Lecture on 14 Sept. next. The title is to be the "Evolution of Instrumentation" and the venue will be the Recital Room of the Royal Festival Hall, London. A limited number of tickets for the lecture are available from the PRO, Ultra Electric (Holdings) Ltd., Western Avenue, Acton W.3.

TV sales fall—radio up

IN May and June, radio and television retailers sold an average of 5 and 3·7 TV sets per shop, according to RTRA. This compares with 5·6 and 5·3 for the same months in 1959. But radio sales were up in both months, compared with 1959 and were higher in June than in May. In the two months, 42·1% and 42·9%, respectively, of the TV business was on h.p., a big drop from the 55·3% and 52·5% figures returned for 1959.

COLLIERY DISTRIBUTION

AGECROFT is one of the collieries the NCB is developing in Lancashire to replace old and uneconomic pits. Amongst the extensive electrical equipment that has been installed in anticipation of an early start to production has been an extensive switchgear installation built up from Crompton Parkinson metalclad units. There is a 23 unit, 11 kV, 250 MVA single-busbar switchboard, together with a 15 unit 3·3 kV 50 MVA duplicate busbar board and an associated 24 unit remote-control panel, housing control and protection equipment and instruments. This board also has a full mimic diagram extended to show the l.v. distribution system. Incoming supply to the colliery is taken from the local NWEB 11 kV network.

* * *

The 15-unit duplicate busbar 3·3 kV switchboard has 50 MVA circuit-breakers.

His Excellency the Japanese Ambassador had much to see when he visited the Hunterston nuclear power station recently. He is seen here with Mr R. N. Millar (left), managing director of the G E C engineering group and (talking to him) Mr D. W. T. Angwin, GEC's chief resident engineer at Hunterston

Electrical Contacts Symposium

INTENDED mainly for persons concerned with the design and improvement of contacts as applied to light electrical engineering, a symposium covering recent advances in the study of contact phenomena is to be arranged by the Institute of Physics and The Physical Society, to take place at the Brunel College of Technology, on 5-7 April, 1961. Main interest will be centred on aspects relating to contact resistance, but mechanical and electrical erosion, material transfer and surface film contamination will also be considered.

A number of short papers have already been invited by the organising committee, but other contributions will be welcomed for consideration. Abstracts will be circulated before the symposium, but the proceedings will not be published in full. Further inquiries should be addressed to the Secretary, The Institute of Physics and The Physical Society, 47 Belgrave Sq, S.W.1.

Morphy-Richards plan heater campaign

EXTENSIVE sales promotion is planned by Morphy-Richards in the heater field during the coming season. Based on advertising under the theme "pound for pound your shrewdest heating buy," the campaign will also include a window-dressing competition attracting £1,600 in cash prizes, new display material for retailers and subsidising of local Press advertising at up to three-quarters cost. The M-R Blue Chip packaged h.p. deal will, of course, be pushed during the campaign.

The pound for pound theme will be pushed in relation to cooking and laundry appliances, in an October to December advertising campaign concentrating on the largest possible audience of housewives.

Christmas Holiday for Cable-makers

CABLE-MAKERS' works are recommended by the Joint Industrial Council for the Electrical Cable-making Industry to select Tuesday, 27 Dec. as a holiday under the terms of their agreement on payment for statutory holidays. Any work on 25 Dec., or on a day (preferably 27 Dec.) substituted for Christmas Day, since this is a Sunday, is to be paid at double time, while time worked on Boxing Day, Monday, 26 Dec., is to be paid at time and a half for day shift work.

Cheaper TV Tubes

A NEW company is to manufacture and sell television tubes at prices it claims will be appreciably lower than at present offered by other manufacturers in this country. The company, Cathode Ray Tubes Ltd., will market their product under the name "Lifeguard." The new tubes, which will carry a 12-month guarantee, are priced: 14 in. £9 15s, 17 in. £10 10s and 21 in. £14 15s. They show, respectively, a retail saving of 15s, 30s and 25s, compared with current lowest list prices of other makes.

Increased Japanese Competition

INCREASED exports to Western Europe is a high priority aim for Japan, if some interpretations of a speech by the Japanese Foreign Minister are correct. The speech was made to an assembly of Japanese diplomats in Western European countries, which had as its official object the discussion of ways of expanding Japanese exports to the area to compensate for a drop in sales in African markets.

Welding Translation Project completed

COVER-TO-COVER translation of two Russian monthly welding journals for 1959 has recently been completed by the British Welding Research Association. The Association has found in the journals evidence of enthusiasm and earnestness in Russian engineers, a willingness to submit ideas and vigorously criticise those of other authors.

Although some of the information in the journals is outdated by Western standards, it shows a marked awareness by Russia of technical shortcomings and evidence of powerful drive to overcome these.

Amongst ideas arising from remoteness of some areas becoming important in Russia, is the development of flat coiled and welded aluminium pipe line, which on site is restored to round section with compressed air, giving continuous runs up to 600 metres long.

E.M.I. — M-R Conditions

FORMAL offer by EMI for the ordinary stock of Morphy-Richards went out to M-R shareholders last week confirming the two-for-three shares exchange proposal. EMI say it is intended that both they and M-R shall retain their separate identities and continue trading under their own names. The EMI board is convinced that the proposed amalgamation would greatly strengthen the position of the two companies in the domestic appliance field, both at home and abroad. EMI have established business in some 26 overseas countries and consider they could offer considerable assistance to M-R in export trade and overseas activities.

The takeover offer is conditional on 90% of Ordinary stock being offered to EMI, including the 27% they held at the time of the offer.

Metal Manipulation Conference

RECENT technological developments in methods of manipulating metals, other than cutting, are to be the subject of a conference organised by the Institution of Production Engineers from 12-14 Oct. The conference will be held at Brighton with an opening address by Dr D. F. Galloway, Director of the Production Engineering Research Association. There will be talks on extrusion techniques, precision forging, forming by rolling, and sheet forming.

33 kV Undergrounding Not Justified

AFTER considering the evidence at a public inquiry, the Minister of Power has approved an Eastern EB plan to use overhead lines for a 33 kV reinforcement scheme for supplies to Epping and Ongar. The Minister has accepted the view of the inspector conducting the inquiry that the Board had selected the best route for the lines and that undergrounding of various stretches at costs of several tens of thousands of pounds was not justified in terms of the improvement that would result.

Title of New Holding Co.

COMBINED Electrical Manufacturers Ltd. is the title chosen for the new holding company formed from the merger of Hackbridge and Hewittic Electric Ltd. and Switchgear and Cowans Ltd. The new concern is to acquire the issued capitals of both companies on an exchange basis—seven for four Hackbridge 5s units and two for one S and C 5s share, as we reported on 11 Aug.

Engineers and Industrial Design

A COURSE in the appreciation of design is being arranged for apprentices and junior engineers by the Council of Industrial Design. The course will be held in London in November and December and will run in two residential periods. The initial aim will be to make participants aware of design in its widest context. The design of particular products will be examined and analysed in detail and students will be required to make recommendations for the improvement of the examples selected.

BELFAST TO CUT TARIFFS

NET surplus of £791,094 is recorded for the Belfast Electricity Undertaking in the year ended 31 March last, following gross profit of £989,527. Sales totalled 531 million units, an increase of 7·69% on the previous year. The report notes growth of off-peak supplies, and says an all-electric housing estate has proved a success. With the commissioning of the first 30 MW set at the new Coolkeeragh power station, the East Bridge St Station is no longer required, and plant is to be dismantled.

The report proposes a reduction in off-peak tariff for space and water heating, and a reduced fuel cost adjustment clause in industrial tariffs to take account of better generation efficiency.

Sayings OF THE WEEK

"The pulsating beat emitted late at night is reminiscent of the jazz festival at Lord Montagu's residence." . . . COUNC L. W. AUSTIN, complaining at a Douglas, IoM, Town Council meeting about noise of diesels at the Pulrose power station.

"Do not regard science as a fairy wand that can be waved over a poor country and convert it into a rich one." PROF P. M. BLACKETT, addressing a conference in Tel Aviv on African and Asian countries' development.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, August 23

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	244	+1⅛
,, (3 months)	242¾	+⅝
LEAD, refined pig, 99·97% purity (cash)	71⅛	+½
,, (3 months)	71½	+⅜
TIN, refined, min. 99·75% purity (settlement)	802	+5½
,, (3 months)	804½	+6
ALUMINIUM, ingots 99·99·5% ...	186	—
,, wire bars (4 × 4 × 54")	193½	—
BRASS Strip 63/37	214½	−4
SILVER (Troy oz)	79¼d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	86½	−1⅜
,, (3 months)	86⅛	−2⅛
RUBBER, per lb No. 1, RSS, spot	28d	−1⅛d
c.i.f. basis, ports, Oct.	28d	−1⅛d
ARMOURING: Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	69⅜	−⅜
AMERICAN PRICES: Copper, electrolytic (per lb) ...	33c	—
Lead, (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

The Non-Apprentice in Industry

SYSTEMATIC training of boys entering into unskilled and semi-skilled industrial occupations is stressed in a booklet published by the Industrial Training Council, entitled "Training Boys in Industry—The Non-Apprentice."

It is estimated that two-thirds of Britain's industrial labour force is unskilled or semi-skilled and this proportion is unlikely to diminish in view of current industrial trends. Except in the case of a few enlightened firms, whose training methods are described in the latter half of the ITC booklet, this majority is poorly catered for by comparison with facilities available to apprentices to skilled trades.

Experience by these firms and that gained abroad has proved the value of systematic training for specific occupations. The type of training scheme envisaged is to provide both a vocational and general training for industry. In the case of suitable individuals, further education at evening classes and by day release is considered desirable.

Strikes in State Industries

TRADES unions must have the right to call strikes in nationalised industries and public services, even when the cause of dispute is Government action. That is the opinion of the TUC, expressed in the annual report published last week. In discussions of the point with individual unions, there was some support for negotiating wages by comparison with pay in other industries, but the TUC General Council seems against this.

The report also discusses joint consultation in electricity supply. Several of the unions concerned have praised the machinery and its operation.

Lower Cost Baths Heating

USE of electric thermal storage heating for proposed swimming baths at Coventry will save £50,800 in building costs as compared with coal, and four men will be required to operate the plant as compared with 10 if coal is used. So the City Markets and Baths Committee has approved the electric system, and tenders are to be invited from specialist firms.

News in Brief

Work has started on a new £195,000 seven-storey building at Finchley, London, which will be headquarters for the CEGB's Southern Project Group.

Closing date for the EIBA competition for design of a new emblem is 13 Sept. Particulars of the competition can be obtained from the Association at 10 Buckingham Palace Gardens, S.W.1.

A draft purchasing specification (GTA/101) for continuous filament glass fibre yarns has been published by the Glass Textile Association.

AEI Lamp and Lighting Co. are arranging an exhibition "Mazda brings outdoors indoors" at the British Colour Council premises, 13 Portman Sq, W.1, from 2 to 9 Sept. (except 4 and 5 Sept.).

Electric trains ran for the first time last week on London Transport's newly electrified stretch of line between Rickmansworth, Amersham and Chesham (Metropolitan Line). At present only training journeys are being made; passenger services will start on 12 Sept. next

Company Activities

IT speaks much for the underlying resilience of stock markets that, following the fairly sharp set-back on the July import/export figures which revealed a yawning "trade gap" of £104 million against £71 million in June and a monthly average of £64 million in the first six months of 1960, they made a sunny enough comeback towards the end of the week. It seems excuses are always to be found for the market's apparently irrepressible ebullience. Although the trend of exports is still down and that of imports still up, the market shrugged off its initial disappointment with the consoling thought that the trade figures would not yet reflect the ex-Chancellor's measures to improve them, due to the long time-lag between the placing of orders by foreigners and the eventual execution and dispatch of those orders. It is further pointed out that our losses on visible trade are as likely as not being offset by increased "invisible" earnings for which we do not have figures and that with a 6% Bank Rate here against rates of only 3% or little more in the United States, our gold and currency reserves must be raking it in. Such "hot money," however, can easily melt away and all too rapidly following any increases in interest rates in other international financial centres. And if our poor performance with exports were not being "hot money" subsidised with the aid of our money-magnetic 6% Bank Rate, the market might soon find reason enough to whistle a less carefree tune.

By way of contrast, however, the majority of leading electrical shares turned dull after the previous week's brilliant showing. It could be that the cut in hours from 44 to 42 for workers in the electrical contracting industry announced by the National Federated Electrical Association after agreement with the ETU has helped to keep this particular section somewhat in check. Thus AEI after opening the week at 51s 7½d finished at 49s 6d, while GEC dropped back from 39s 3d to 37s 6d and Parsons moved down from 52s 6d to 51s 6d. English Electric, going ahead to 40s 10½d then down to 40s before the unchanged interim dividend of 3%, finished the week at 38s 6d, but Telefusion with its gross profit 60% up at £1·14 million and its dividend increase from 16⅔% to 27½% was a good enough result to lift the 5s Ordinary shares 4s 3d over the week to 35s 6d. Strand Electric, too, with a 10½d jump to 19s 9d were a good market on their results which showed a rise in consolidated net profits from £34,771 to £57,677, a proposed one for two free scrip issue and an increased dividend which will amount to the equivalent of 22% against the 20% paid last time. Hoover "A" shares helped by the industry's bigger washing machine exports in the first half of 1960—at £3·7 million they were £1·2 million up on the corresponding period of 1959—cheered up from 41s 9d to 42s 7½d, while appliance makers Vactric were wanted, 2s 9d dearer, at 24s. But to out-balance these few brave performances there were plenty of falls up to 6d as with Plessey, Thorn Electrical, Decca Record and E. K. Cole, while on the latest take-over position, with the EMI bid now in the hands of Morphy-Richards shareholders, EMI dropped back from 47s 9d to 46s 3d, and selling in the market lowered Morphy-Richards 4s Ordinary shares from 31s to 29s 10½d. And despite the strong order-book position of Metal Industries, which now takes in Lancashire Dynamo, chairman Sir Charles Westlake's annual statement was received with a 5s 3d drop in the £1 Ordinary shares to 68s 6d before recovering to 69s 10½d. A substantial programme of capital expenditure is now under way and Sir Charles estimates that the net proceeds of the recent "rights" issue, amounting to around £3,893,000, will provide sufficient funds in hand for current needs. Dividend yield is 4.3% and, in my view, now would not be an inopportune time to buy.—*From our City Correspondent.*

John E. Dallas and Sons

This company, controlled by Keith Prowse, is paying a dividend of 7% (*same*) for the year to 31 March last, but net profit has risen from £22,909 last year to £29,206. Both fixed and current assets show a slight fall. The chairman, Mr P. E. Cadbury, draws attention to the effect of the credit squeeze on sales of radio and electrical equipment, but suggests that there should be increased turnover from the musical department.

Hackbridge Holdings

Although the group profit for the year to 31 March dropped to £276,777 from the previous year's total of £321,202, dividend is maintained at 20% with a final of 12½%. It is also proposed to make a one-for-one scrip issue. The directors point out that the 20% dividend has been paid for a number of years, and, but for the increased depreciation provided—£116,141 against £59,380 last time—the cover would have been similar to that of last year.

Lancashire Dynamo Holdings Ltd.

Although now a subsidiary of Metal Industries, the accounts of this firm to 31 Dec., 1959, have been published separately. They show an increase in trading profit after charging depreciation, etc., from £836,446 in 1958, to £863,273 last year, but owing largely to an increase in taxation equalisation reserve, the after-tax profit is lower, at £366,755 (*£396,796*).

Metal Industries Ltd.

The major event of the year, Sir Charles Westlake mentioned in his review, has been the acquisition of the Lancashire Dynamo Group. This has led to doubling of the number of employees and of increasing the number of subsidiary companies from 16 to 38. The Lancashire Dynamo accounts are, however, kept separate in view of the short period of control. The trading profit, after depreciation, of Metal Industries companies has increased by £218,752 and the order book is reported to be in a strong position. The subsidiaries, Towler Bros and Avo Ltd., are expanding turnover and the integration of Brookhirst and Igranic has led to a reduction in overhead expenses. The integration of Lancashire Dynamo will take some time, it is considered. Cable Jointers and Malcolm and Allan, the two firms concerned with installation work, are being brought under a single management. A substantial programme of capital expenditure is now under way, including substantial extensions to the Rugeley factory of Lancashire Dynamo Electronic Products.

Year to 31 Mar.	£ Trading Profit	£ Net Profit	% on Ord		Ord. Price	
			Earned	Paid	High	Low
1956	—266,861	—423,878	Nil	Nil	27/1	16/3
1957	1,878,562	800,097	34	14	30/6	20/3
1958	1,880,866	779,753	33	14	44/3	22/9
1959	1,764,673	765,018	28	14†	75/3	39/10
1960	2,136,569*	856,919*	32	15†	77/3	59/6

* Not including Lancashire Dynamo Group.
† On £4,140,338 capital.

Radio and Television Trust

A change of accounting year prevents comparison of accounts, but for the nine months ended 31 March the consolidated profit was £118,060 (*£138,482* for 15 months). The figure includes £25,742 in respect of three months' profit of the newly acquired British Communications Corp. The dividend for the nine months is 15% less tax. A scrip issue of one-for-two is proposed.

Strand Electric Holdings

The proposal for a one-for-two scrip issue underlines a successful year of trading. The final dividend of 10% will be paid on the capital as increased, making 22% for the year compared with 20% for 1958-59. The balance before tax was £93,573 (*£65,626*) and the net profits have risen to £57,677 from £34,771 last year.

Dividends Declared

English Electric Co. Interim on Ord. 3% (*same*).

Automatic Telephone and Electric Co. Interim 5%.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

25 Aug.—Cardiff C.C. Electrical installation on fixed price basis by contractor on N.I.C.E.I.C. Roll in "Bryn-y-Don," Approved School, Dinas Powis.—See 11 Aug. issue.

25 Aug.—Shannon Airport. Provision of electrical services in new freight terminal buildings.—See 11 Aug. issue.

26 Aug.—Maidstone B.C. Supply and erection of 1, 2 and two of 4 m.g.d. effluent recirculation pumps together with humus and top water pumps, pressure effluent pumps, motors, control gear, pipework and valves at Aylesford Sewage Disposal Works extension, contract M.11.—See 18 Aug. issue.

27 Aug.—Cork C.C. Supply and erection of 300 g.p.m. centrifugal pumps and motors for Allow Regional Water Supply Scheme. —See 11 Aug. issue.

27 Aug.—Staveley U.D.C. Supply and erection of 56 concrete columns, sodium lanterns, auxiliary gear and cable laying on A619, Worksop Rd.—Advertised 4 Aug. issue.

29 Aug.—Cannock U.D.C. Supply, erection and wiring of: (a) 23 140 W sodium lamps and one 3 x 80 W fluorescent on 25 ft concrete columns along B.5013 Station Rd, Hednesford; (b) 50 100 W tungsten lamps on new and existing columns. Engineer and Surveyor, E. Lomax, Council Hse, The Green. Deposit £2 2s.

29 Aug.—Colwyn Bay B.C. Provision and erection of five Class "A" concrete columns with lanterns, control gear, etc., for A55 Section 6 lighting.—Advertised 18 Aug. issue.

29 Aug.—Hoyland Nether U.D.C. Electrical installations in 20 four-bedroom and 180 three-bedroom existing houses Coronation Rd site, Hoyland.—See 18 Aug. issue.

29 Aug.—Isle of Ely C.C. Supply of (Part E) electrical equipment for Junior Training Centre for Subnormal Children at Wisbech. —See 18 Aug. issue.

29 Aug.—Liverpool C.C. Supply of cables and electrical sundries. Central Purchasing Officer, New Oxford Hse, 75 Dale St, Liverpool 2.

29 Aug.—Llanelly B.C. Installation of communal television aerial for 44 dwellings, Western Works. Borough Architect, 5 Goring Rd.

29 Aug.—New Forest R.D.C. Renewal of electrical installations in 19 houses, Addison Rd, Brockenhurst. Engineer and Surveyor, Council Offices, Lyndhurst. Deposit £2 2s.

29 Aug.—Soke of Peterborough C.C. Lighting and power installation by contractors on N.I.C.E.I.C. Roll or E.C.A. members in 36-bed Home for the Aged, Alderman's Drive.—See 18 Aug. issue.

29 Aug.—Whickham U.D.C. Provision of street lighting along Dunston Rd C.118; Wellington Rd and Gasworks Bridge Rd C.118; and Ravensworth Rd, Dunston.— See 18 Aug. issue.

31 Aug.—Breconshire C.C. Electrical installation by contractors on N.I.C.E.I.C. Roll or E.C.A. members in new council chamber. —See 11 Aug. issue.

31 Aug.—East Barnet U.D.C. Contract 927, (a) (i) Supply and erection of 87 25 ft and 62 15 ft concrete columns/brackets and of 12 15 ft c.i. columns/brackets; (a) (ii) resiting of 160 15 ft metal and 25 15 ft concrete columns/brackets; (b) supply and fitting of 87 140 W, 220 60 W and fitting only of 66 60 W sodium vapour lanterns; (c) wiring.—See 18 Aug. issue.

31 Aug.—Leighton Buzzard U.D.C. Maintenance of street lighting system.—See 11 Aug. issue.

31 Aug.—Manchester C.C. Contract 242E electrical installations in 15 houses and flats at Langley.—See 18 Aug. issue.

31 Aug.—Newcastle-on-Tyne C.C. Supply and installation of two automatic lifts in each of seven 13-storey blocks of flats at Pottery Bank and Scotswood Rd.—See 11 Aug. issue.

31 Aug.—Oxfordshire C.C. Supply and erection of seven 35 ft steel columns with 200/280 W sodium lanterns and five 25 ft steel columns with 140 W sodium lanterns and gear at Littlemore. County Surveyor, 8 New Rd, Oxford.

31 Aug.—Renfrew T.C. Erection of alternative (a) 3 x 80 W fluorescent and (b) 400 W mercury schemes for A8 Inchinnan Rd street lighting improvement.—See 21 July issue.

31 Aug.—Saltburn and Marske U.D.C. Electrical installations in 42 houses on Marske La site.—See 18 Aug. issue.

31 Aug.—Wilton B.C. Installation of street lighting at Bulbridge Private Development Estate.—See 28 July issue.

1 Sept.—Dundee T.C. Supply and erection of multi-stage centrifugal pumps, accessories and switchgear for Menzieshill Pump Hse.—See 21 July issue.

1 Sept.—Farnborough U.D.C. Installation of 218 power points in 48 dwellings on Knellwood estate.—See 4 Aug. issue.

1 Sept.—Hale U.D.C. Installation, on fixed price basis, of 210 mercury vapour lamps on 15 ft concrete columns on various roads. Engineer and Surveyor, Council Offices, Hale, Cheshire. Deposit £2.

1 Sept.—Kirkby-in-Ashfield U.D.C. Supply and installation of two 20 c.f.m. and one 35 c.f.m. sewage pumps and one 35 c.f.m. sludge pump complete with starters, switchgear, cables, etc.—See 28 July issue.

1 Sept.—Warrington R.D.C. Installation of 48 Class "B" street lighting units on A574, Warrington Rd, Risley.—See 21 July issue.

1 Sept.—Westmeath C.C. Supply and erection of two 9,000 g.p.h. centrifugal pumps/motors for Moate water supply scheme.— See 18 Aug. issue.

2 Sept.—Dublin C.B. Supply of 200 street lighting lanterns.—See 11 Aug. issue.

2 Sept.—Maidenhead B.C. Erection of 26 15 ft and two 25 ft reinforced concrete columns and fixing fluorescent lanterns/gear and all incidental works.—See 18 Aug. issue.

2 Sept.—Rothwell U.D.C. Provision and erection of 73 140 W sodium units with concrete columns along Leeds-Exeter Trunk Road, A61.—See 11 Aug. issue.

2 Sept.—Stockport T.C. Electrical installation in Secondary Technical School for boys, Pendlebury Hall, Lancashire Hill. Director of Education, Town Hall.

3 Sept.—Cambridge C.C. Supply of (Item d) lamps.—See 14 July issue.

3 Sept.—Irlam U.D.C. Supply and erection of three pumps, any two of which should deal with 350 cu ft per min at 36 ft head of unscreened sewage.—See 11 Aug. issue.

5 Sept.—Manchester C.C. Supply and erection of lighting equipment/auxiliary services for primary sludge digestion plant.—Advertised 4 Aug. issue.

6 Sept.—Dartford B.C. Supply and erection of 91 Group "A" 400 W MBF/U lamps/lanterns on 25 ft reinforced concrete columns for town centre approach roads.— See 11 Aug. issue.

6 Sept.—Lisburn U.D.C. Supply and erection of fluorescent street lighting equipment for improved lighting to Group "B" or Intermediate standards.—See 11 Aug. issue.

6 Sept.—Manchester C.C. Supply of street lighting equipment for year from 1 Jan., 1961, comprising: cable, concrete and columns, flashing beacon globes, road sign fluorescent fittings, globes, lanterns, time switches and traffic bollards.—Advertised 18 Aug. issue.

7 Sept.—Birmingham T.C. Alterations and additions, on a firm-price basis, to electrical installation, Highbury Hall, Queensbridge Rd. Engineer and Surveyor, Sir Herbert J. Manzoni, Civic Centre. Deposit £2 2s.

7 Sept.—Cheadle and Gatley U.D.C. Supply and erection of 39 Group "A" pre-stressed spun concrete columns with 140 W sodium lamps/lanterns along Manchester Rd.— See 11 Aug. issue.

8 Sept.—Guildford B.C. Supply, erection, cabling and bringing into service of 117 Class "A" lighting along A3100, A246 and A321.—Advertised 11 Aug. issue.

8 Sept.—Staines U.D.C. Provision and installation of 215 Class "B" tubular steel columns, lanterns and gear, also dismantling, resiting or adjustment to 252 c.i. columns. Engineer and Surveyor, 240 London Rd. Deposit £2 2s.

9 Sept.—Glasgow T.C. Supply of 5,000 bracket fittings for lighting stairs.—See 18 Aug. issue.

9 Sept.—Luton B.C. Electrical installation in Challney CSM School extension.—See 18 Aug. issue.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 110 queries answered this week

"Pilmore" compressor type refrigerators—address for spares? R.T.P.—A.C.R.E. Refrigeration Co., 389 Green Lanes, N.4.

"Sunfra" infra-red elements—makers of? G.E.—Watson and Sons (Electro-Medical) Ltd., East La, North Wembley, Middx.

"Bellino" soin driers—agents for? G.H.—Ideal Home Domestic Electric Centre, 416 Green St, E.13.

"Xcel" electric fires—address for? P.I. —Selex Electric Co. (Kirkby) Ltd., Yardley Rd, Kirkby Industrial Estate, Kirkby, near Liverpool.

"Rowenta" electric saucepans—agents for? L.E.B.—Rowyn Ltd., 216 High St, Kensington, W.8.

"Baker" thermostats—makers of? S.E. —P. W. Baker and Sons (Sales) Ltd., Eastergate, Chichester, Sussex.

"Metalair" electric clocks—makers of? T.E.—Metalair Ltd., Embrook Mill, Reading Rd, Wokingham, Berks.

M.E.A.C. Ltd.—address for? M.V.—1 Chesterfield St, W.1.

"Sanaburn" incinerators—address for? E.T.—Stratton and Brodie-Chase Ltd., 128 Ebury St, S.W.1.

9 Sept.—Worksop B.C. (1) Supply of lanterns, lamps and auxiliary equipment; (2) removal of existing units, supply of new columns, wiring and fitting of equipment; (3) alternatively, whole of work for 100 140 W sodium units on 25 ft columns.—Advertised 18 Aug. issue.

9 Sept.—Wrexham B.C. Supply and erection of Scheme 4 Groups "A" and "B" columns, brackets, lanterns and lamps.—Advertised 18 Aug. issue.

10 Sept.—Waterford C.C. Supply of two 20 g.p.m. centrifugal pumps and motors for Kill and Bonmahon Water Supply Scheme.—See 28 July issue.

10 Sept.—Willenhall U.D.C. Erection of 92 Stanton 9A concrete columns and provision/fixing of 80 W mercury lanterns/lamps with necessary wiring.—See 4 Aug. issue.

10 Sept.—Youghal U.D.C. Duplicate pumps with 190 g.p.m. combined capacity and another pair for 1,410 g.p.m. at a maximum static lift of 53 ft.—See 18 Aug. issue.

12 Sept.—Herefordshire Hospital Management Committee. Renewal of electrical installations Ross Hospital, Gloucester Rd, Ross-on-Wye. Sectional Superintendent Engineer, General Hospital, Hereford.

12 Sept.—Kilbride. Electrical work, Presbyterian Church. W. D. R. and R. T. Taggart, 13 College Gdns, Belfast 9. Deposit £4 4s.

12 Sept.—Manchester C.C. Electrical installation in Withington Library. City Architect, Town Hall, P.O. Box 488, Town Hall.

12 Sept.—Pontypridd U.D.C. Supply, erection, wiring and testing, on firm-price basis, of 32 steel columns complete with Group "A" mercury lighting and 32 similar lighting units with brackets for use on existing columns/buildings for Town Centre and Rhondda Rd, A4058, lighting. Engineer and Surveyor: W. C. Evans, Municipal Bldgs. Deposit £2 2s.

13 Sept.—Londonderry R.D.C. Electrical installations in 18 dwellings, Altinure, and 16 dwellings, Claudy Brae.—See 11 Aug. issue.

15 Sept.—Portadown. Electrical installation and lift, old people's home, Gilford Rd. Houston and Beaumont, 9 Market St, Lurgan. Deposit £3 3s.

16 Sept.—Lisnaskea. Electrical installation in fire station. Hedley B. Raid, Secretary, N. Ireland Fire Authority, 43 Castle St, Lisburn. Deposit £2 2s.

19 Sept.—Rawtenstall B.C. Electrical work in erection of new mortuary, Rawtenstall Cemetery, Burnley Rd. Borough Engineer and Surveyor, Town Hall. Deposit £2 2s.

19 Sept.—Sunderland B.C. Electrical installation to extensions and alterations to Railway Row Clearing Depot. Town Clerk, Town Hall.

No date stated—Whitby U.D.C. Supply and erection of 117 Group "A" steel octagonal columns, five wall brackets, seven Group "B" steel columns with 250 W colour-corrected mercury and 80 W mercury fluorescent lamps/lanterns/control gear.—See 4 Aug. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

30 Aug.—America. One 2·5 kV motor control gear for one 1,350 and two 1,500 h.p. motors and 600 V station service control gear. Bureau of Reclamation, Bldg 53, Denver Federal Center, Denver 25, Colorado. B.o.T. (ESB/20381/60).*

31 Aug.—Canada. Two 69 kV 2,500 MVA o.c.b's for Nos. 20 and 22 substations. Chairman, Committee on Utilities and Personnel, c/o. City Clerk, City Hall, Winnipeg 2. B.o.T. (ESB/20770/60).*

1 Sept.—Australia. Two 2 MVA 33/3·3 kV transformers. Design Dept., Electricity Trust of South Australia, Hindmarsh Bldg, Grenfell St, Adelaide. B.o.T. (ESB/20368/60).*

1 Sept.—Burma. 105,000 yd 3/·036 and 35,000 yd 7/·036 twin lead covered cable. Director-General, Union of Burma Purchase Board, St. John's Rd, Rangoon. B.o.T. (ESB/21337/60).*

5th Sept.—Pakistan. 25 drilling machines and 16 portable drilling machines. Director of Stores, Water and Power Development Authority (Power Wing), Lahore. B.o.T. (ESB/21379/60).*

7 Sept.—India. Four items iron clad fuse splitter boards. Purchase Officer, Sindri Fertilisers and Chemicals Ltd., Sindri. B.o.T. (ESB/21385/60).*

8 Sept.—India. 76 switch fuse boards, six-way, watertight with six 15 A, 250 V switches. Purchase Officer, Sindri Fertilisers and Chemicals Ltd., Sindri. B.o.T. (ESB/21384/60).*

13 Sept.—New Zealand. Six metal clad, 27-panel, duplicate busbar switchboards. Town Clerk, P.O. Box 2199, Wellington. B.o.T. (ESB/20169/60).*

19 Sept.—Australia. (1) 106 s.ph. capacitor voltage transformers for use on 132 kV system. (2) 75 s.ph. capacitor voltage transformers for use on 330 kV system. Commercial Manager and Secretary, E.C. of N.S.W., Box 5257, G.P.O., Sydney. B.o.T. (ESB/20723 and 4/60).*

19 Sept.—India. Five items of station type lighting arresters. Superintending Engineer Technical (Electrical), Madras State Electricity Board, 157, Mount Rd, Madras 2. B.o.T. (ESB/21025/60).*

19 Sept.—Libya. Four 1 MVA transformers for Tripoli power project. President, Central Tenders Committee, Ministry of Finance, Tripoli. B.o.T. (ESB/20143/60).*

19 Sept.—Thailand. 170,000 lb all-aluminium bare conductor. Commercial Dept., Metropolitan Electricity Authority, 121 Chakraphet Rd, Bangkok. B.o.T. (ESB/20313/60).*

20 Sept.—Thailand. 4,000 7½ in. dia. 5¾ in. long suspension type insulators. 15,000 pin type 23 kV insulators and 4,000 l.v. pin type insulators. Metropolitan Electricity Authority. B.o.T. (ESB/20314/60).*

21 Sept.—New Zealand. Twelve 50 A, six 250 A and six 750 A 250 V knife blade open pattern slow break switches. Director-General (Stores Division), G.P.O. Wellington. B.o.T. (ESB/20326/60).*

21 Sept.—Pakistan. 2 million ft 3/·029 single core wire; 887,500 ft 3/·036 to 37/·083 v.i.r. cable; 50,000 ft twin 3/·20 weatherproof wire. Dept. of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/20320/60/ICA).*

22 Sept.—Argentina. Ten diesel-electric locomotives. Argentine State Railways Administration, Av Corrientes 389, Buenos Aires. B.o.T. (ESB/21045/60).*

22 Sept.—New Zealand. 312,562 ft p.i.l.s. telephone cable. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/20786/60).*

25 Sept.—Iran. 14 items underground cable in quantities from 100 to 4,900 metres. The Sugar Factories of Iran, Teheran, Iran. B.o.T. (ESB/19564/60).*

26 Sept.—Nigeria. Indoor and outdoor 33 kV switchgear, control and relay equipment for Lagos substations. Contract 1,033/78. Resident Engineer, Electricity Corporation of Nigeria, Adelphi, John Adam St, W.C.2

27 Sept.—New Zealand. 300 electrolytic capacitors. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/20784/60).*

28 Sept.—Pakistan. 511 tons 2, 3, 4, 6 and 8 s.w.g. hard drawn bare copper wire and 20·1 tons 14 and 16 s.w.g. copper binding wire. Dept. of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/20728/60/ICA).*

28 Sept.—Uruguay. Three items of insulators and three items aerial c.b's. Administracion General de las Usinas Electricas y los Telefonas del Estado, Montevideo. B.o.T. (ESB/21331/60).*

29 Sept.—New Zealand. 5,000 fuse mountings of 20 pairs. Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/21423/60).*

1 Oct.—Pakistan. 4,400 10 A, 1,000 40 A and 500 3 by 20 A 230 V, 50 c/s house service meters. Director-General, Dept. of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/20774/60/ICA).*

4 Oct.—Pakistan. 1,650 strain insulators, disc type, 4,200 11 kV pin-type insulators, 92,000 600 V shackle insulators, 3 in. by 3¼ in., 7,500 5 in. by 4¼ in. shackle insulators, 57,000 reel insulators, 8,000 stay insulators. Director-General of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/20773/60/ICA).*

6 Oct.—Uruguay. Four items of cables and bare copper conductors. Administracion General de las Usinas Electricas y los Telefonos del Estado, Montevideo. B.o.T. (ESB/21332/60).*

7 Oct.—New Zealand. Five 33 kV outdoor high speed o.c.b.'s, two 33 kV/110 V transformers: control and protection cubicle; six surge diverters. Town Clerk, Palmerston North City Council, P.O. Box 614. B.o.T. (ESB/21424/60).*

15 Oct.—Trinidad and Tobago. Supply of transformers. Purchasing Officer, Electricity Commission, P.O. Box 121, Port-of-Spain.—Advertised in this issue..

CONTRACTS PLACED

Barking B.C. Electrical installation in Thames View Hall, London Electricity Board, £1,156. Recommended.

Beddington and Wallington B.C. Rewiring of 157 houses on Bute and Demesne Rd estates, H.R. Installations Electrical Co., £5,328. Recommended.

Cardiff C.C. Electrical installations in Windsor Clive School, D. and D. (Cardiff), £1,760. Recommended.

Darlington T.C. Floodlighting of playing area at Houghton Secondary School, Doves (Darlington) Ltd., £335. Supply and installation of electrical equipment at new crematorium, North Eastern E.B., £991.

Dewsbury B.C. Electrical work in Redevelopment Area 1 dwellings, Hammerton and Waring Ltd., £1,091.

Durham C.C. Electrical installation at Lizards Farm, Sedgefield, J. Paterson and Co., £586.

Guildford B.C. Electrical installation, etc., in Civic Hall, Strand Electric and Engineering Co. Ltd., £12,800. Recommended.

Eston U.D.C. Street lighting improvements, High St and Church La, Cohen Bros. (Electrical) Ltd., £1,987 6s 2d.

Fylde Water Board. Electrical installation in H.Q., Bennison and Co. (Blackpool) Ltd.

Ilford B.C. Supply of: 1,105 post top lanterns, 605 columns and 1,105 sets of control gear, Atlas Lighting Ltd., £6,353, £6,866 and £3,922 respectively; 130 steel columns, Stewart and Lloyds Ltd.; 130 lanterns, Atlas Lighting Ltd. Recommended.

Leyton B.C. Supply of 80 W mercury fluorescent lanterns, Engineering and Lighting Equipment Co., £900, and Class B lamps and control gear, Stella Lamp Co. Ltd., £1,251. Recommended.

Littleborough U.D.C. Supply of 21 Group "B" concrete columns, 60 W sodium lamps, lanterns and auxiliary gear, Engineering and Lighting Equipment Co. Ltd.

Morley B.C. Supply and installation of 140 W sodium lighting units along A58, Concrete Utilities Ltd. Recommended.

Romford B.C. Street lighting improvements along four roads, Engineering and Lighting Equipment Co. Ltd., £2,563. Recommended.

St. Marylebone B.C. Conversion of side street lighting from sodium and mercury to fluorescent at St. John's Wood, General Electric Co., £4,063.

Wood Green B.C. Rewiring of 198 houses on White Hart La estate, A. E. Southey and Co., £5,547. Recommended.

BUSINESS PROSPECTS

Angmering. T. Gerrard and Co., 88 Pentonville Rd, N.1 plan factory, offices, laboratories building, Worthing Rd area.

Barrow-in-Furness. Zenith Carburettor Co., 235 Marylebone Rd, N.W.1, plan, Park Rd factory.

Billingham-on-Tees. British Titan Products plan 8-storey office block Havertton Hill Rd.

Birkenhead. Thermotank Ltd., Merseyside Wks, Kelvin Rd, Wallasey, Ches. plan market St, sheet metal works and electrical sub-station.—B.C. Tender: 83 Woodchurch estate houses and garages. Architect.

Birmingham. J. E. G. Edwards, 68 High St, Harborne, architect for Smith St, industrial premises, Newtown redevelopment area for B. H. Britton and Sons.—Hospital Rd, plan £267,350 Hollymoor Hospital annexe. New department at Selly Oak Hospital to cost £118,00.—W. Midlands Gas Board plans £1 million, 13-storey office block at Broad St. Architect, N. Cooley, Foundry La, Smethwick, Staffs.

Bishop Auckland. Tender: Woodhouse Close Methodist Church. Architects, Cordingley, and McIntyre, Owengate, Durham.

Bognor Regis. West Sussex C.C. approved £147,320 extensions scheme at Training College. Architects: M. Rainsford Fletcher and Ptnrs., 13 Ambrose Pl, Worthing.

Boldon U.D.C. Tender: 102 Wellands La estate houses. Surveyor.

Bournemouth. Planned: four Brickworks site, Ringwood Rd developments by W. T. Burden. Factory extension, Poole La, for Aerograph De Vilbiss Co.—Factory extensions, Wallisdown Rd, for Meggitt Engineering Ltd.—Warehouse, Haviland Rd, for Oswald Bailey (Southern), 34 Commercial Rd, Bournemouth.

Bramhall. Manchester Commercial Buildings, 12 St. Anne's Sq, Manchester, plan redevelopment of Tudor Cinema site.

Brighouse. J. C. Bottomley and Emerson, plan additional storey to Brookfield Chemical Works.

Bristol. W. Boyd, 117 Park St, W.1, chief engineer for £¼ million Avonmouth depot for Regent Oil Co.

Buckley U.D.C. Tender: 109 dwellings Western Park housing extension. Architect: Ronald S. Biggins, Richmond Hse, Boughton, Chester.

Burnley. Clifford Tee and Gale, 43 Frederick Rd, Birmingham 15, architects for £500,000 Joseph Lucas factory in Eastern Ave.

Bury St Edmunds. Gelder and Kitchen, Alfred Gelder, St, Hull, architects for British Maltsters Ltd., Hollow Rd, offices, etc.

Buxton. Otter Controls, Market St, plan Hardwick Sq South extensions.

Cardiff. Kenneth Graham, 10 Churchill Rd, architects for £30,000 refrigerator factory for Westgate Engineers.—Thomas and Evans, Hannah St, Porth, plan £200,000 Llannishen drinks factory.—R. and E. Cornelius, Colchester estate to buy 4,645 sq yds Newport Rd land.

Carmarthen. Co-Partnership, 44 Charlotte St, W.1, architects for £320,000 extensions at Trinity College.

Chatham B.C. Tender: Group 1 12 flats and 10 houses: Group 2 two houses on Perry St site. Engineer.

Chelmsford. Planned: extensions, Waterhouse La for English Electric Valve Co., Taylor and Collister, 70 Victory St, S.W.1.—Derek Walden, 136 New London Rd, architect for five Brockley Rd workshops for Turp and Blackburn Ltd.

Chessington. Eric Firmin and Ptners, Thavies Inn Hse, Holborn Circus, E.C.1, architects for Cox La, Solartron Laboratory Instruments factory.

Chester-le-Street. Fennell and Baddily, Bridge End Chambers, architects for Station Rd glazing factory for J. L. Hawk.

Chichester. Chichester Press Ltd., 14a St. Martin's St, plan industrial development on Terminus Rd industrial estate site.

Colchester. W. J. Lewis and Ptnrs, 68 Cranbrook Rd, Ilford, Essex, architects for Pearl Assurance Co. offices.

Coleraine R.D.C. Tender: 22 Claragh, Kilrea houses. Quantity Surveyor: T. J. Dudley Lewis, 22 New Row.

Cookstown U.D.C. Tender: 79 Monrush houses. Town Surveyor.

Coventry. Walsgrave General Hospital planned at £4,808,322; dental dept. at Coventry and Warwickshire Hospital £23,720, and conversion works, Paybody Hospital, and Whitley Hospital, £15,000.

Cumberland C.C. Civil schemes for library and clinic, rehabilitation centre, etc., total £65,775. Acting County Architects, Portland Sq, Carlisle.

Dalton-in-Furness (Lancs).—J. S. Blair and Son plan Anty Cross, Cemetery La factory extensions.

Dartford. Amalgamated Oxides Ltd. plan Victoria Rd welfare block.

Dearne U.D.C. Tender: 24 bungalows, and community centre, Thurnscoe. Engineer.

Dewsbury. F. Gutteridge and Sons plan extensions at works, 156 Bradford Rd.

Doncaster. Pilkington Bros, St Helens, plan industrial development on 73 acres adjoining Sandall Wks.—Arthur Lee and Sons, plan laboratory and office at Trubrite Wks, Fife St.—Doncaster Gate Hospital extensions planned by Sheffield Regional Board.

Dover B.C. Tender: 20 housing units, St David's Ave, Aycliffe. Engineer, Brook Hse.

Dudley. Birmingham Regional Hospital Board plans £35,350 modernisation of Burton Rd Hospital.

Dundee. Murrayfield Real Estate Co. plan £1¼ million Overgate area development. Architects, Ian Burke, Martin and Ptrns., 11 South Tay St, Dundee.

Durham. Newcastle Regional Hospital Board plans £55,000 ward at Dryburne Hospital.

Ealing. Hallmark Cards (Great Britain) plan factory extensions, Rowdell Rd, Northolt.

Eastbourne. Edwards Instruments Ltd., Kelvin Way, Crawley, Sussex, plan factory at Brampton Rd trading estate.

Eccles. L. Gardner and Sons plan Barton Hall Engine Wks, Hardy St.—British Domolac, Manchester 13, plan Lulworth Rd and Weymouth Rd warehouse offices.

Edinburgh. Merchant Co., 22 Hanover St, Edinburgh 2, plan £¼ million Mary Erskine School for Girls, Ravelstone Hse.

Exeter. S.W. Regional Hospital Board plans £100,000 development of Princess Elizabeth Orthopaedic Hospital, Buckerell Bore Stage One.

Gateshead. Tripe and Wakeman, 16 Fitzhardinge St, W.1. Architects for Schweppes' factory.

Glasgow. R. A. Peacock and Son, Whitfield Bakeries, Ibrox, Glasgow, plan Thornliebank Print Works site, food factory.—J. P. Sim and Co., 93 Clydesferry St, plan factory and offices, Burnfield Rd, Thornliebank.—Mastercraft Tailors, 263 High St, plan alterations to cinema for use as a clothing factory.—Esk Engineering Co., Fishercoates Rd, Burnside, plan workshops, Rosebery Park, Polmadie. Thomson and Ptnrs, 5 La Belle Pl, architects for Toffolo Jackson and Co. factory.

Godalming. Governors of Charterhouse School plan £300,000 modernisation of students' houses.

Halifax. Richard Pickles and Ptnr., 1 Harrison Rd, architects for £¼ million departmental store and multi-storey hotel scheme by O. and C. Estates Ltd.

Harrow. N.W. Hospital Board, Eastbourne Terr, W.2, plans £2 million Northwick Pk Hospital.

Hastings. T. Sibthorpe, 10 Manchester Sq, W.1, architect for block of flats, Grand Hotel site, Regency Mansions for Thorburn Muirhead and Ptnrs.

Hereford R.D.C. Tender: 26 dwellings Clehonger. Clerk.

Horsham. Governors of Collyer's School, plan £168,096 extensions.

Houghton-le-Spring. Durham Divisional Coal Board plans £¼ million reconstruction of Lambton Engine Works.

Hull. J. H. Genner and Co., Marfleet, plan research and development block, Marfleet Ave.—Cresta Caravan Co., 140 Durham St, plan factory, offices, Reservoir Rd.—J. Marr and Son, St Andrew's Dock plan, Walcott St cold store.

Huntingdon R.D.C. Tender: 12 Brampton Bungalows. Surveyor.

Ilford. Braddock and Martin-Smith, East Gallery St, St. John's Chapel, St. John's Wood Roundabout, N.W.8, architects for Clements Rd showrooms.

Kingston upon Thames. Littlewoods Mail Order Stores, Liverpool, plan £¼ million store building.

Lanchester. Reavell and Cahill, Lloyds Bank Chmbrs, Alnwick, Northumberland, architects for R.C. grammar-technical school.

Leics. Gent and Co. plan 7,750 sq ft, New Rd factory, Kibworth.

Liverpool. Hughes Bros., Hanson Rd, Fazackerley, plan laboratory and offices extensions.

London. British Ropes, Charlton Wks, Anchor and Hope La, S.E.7, plan canteen. Architect, Alfred Roberts, 201 Greenwich High Rd, S.E.10.—Production Equipment Co., 88 Fore St, N.18 and Romagna Reproducers to occupy Edmonton B.C.'s £47,850 and £18,395 blocks. Architect to design small factories at Hope Yard, Langhedge La.—M.K. Electric, Rosebery Rd, plan factory extension.—Fleetway Manufacturing Co., Charlton Rd, N.9, plan factory.—City Veneering Mills, plan two-storey factory extension at 1a Kingsway Estate, Angel Rd.—Erno Goldfinger, 69 Piccadilly, W.1, architects for stage two of Elephant and Castle scheme at £1,159,251.—Andrews, Emmerson and Sherlock, 63 Dean St, W.1, architects for nine-storey flats block, Westleigh Ave, S.W.—Sir A. E. Richardson and E. A. S. Houfe, 24 Queen Anne St, W.1, architects for Bryanstone Sq, W.1, block of flats with basement garages.—Keith Parsons, 36 Cedards Rd, S.W.4, plans Ixworth St and Marlborough St block of flats.—R. Seifert and Ptnrs, 28 Gt Ormond St, W.C.1, architects for Putney Bridge Approach offices, and Cromwell Rd, S.W. transit hotel.—In Southwark, Spicers, 19 New Bridge St, E.C.4, plan reconstruction of Redcross Way building.—Victor Bloom and Ptnrs, architects for Grosvenor Wks Site, Station Rd building of five-storeys.

Loughborough. £36,710 for study bedrooms at Training College.

Lowestoft. Boulton and Paul, Riverside Wks, Norwich, plan Waveney Drive factory.

Mitcham. B. L. Clark and Ptnrs, 39 Victoria St, S.W.1, consulting engineers for Morfax Ltd. factory extensions, Willow La.

Newcastle. Roland Burgess Ltd., Pilgrim St, plan four-storey showroom-offices in Blenheim St.

Penn. The Timber Development Association, Tyler's Green, Penn, plan research laboratory.

Peterborough. Plasticasts Ltd., plan Lincoln Rd, Werrington factory extensions.—East Anglian Regional Hospital Board, Cambridge, plan Alderman's Drive outpatients' dept., etc.

Peterlee. Tender: 160 place R.C. School. Architect, D. Brown, 10 Lambton Rd, Jesmond.

Plymouth. T. Barrett, Son and Ptnrs, 50 Pall Mall, S.W.1, quantity surveyors for £800,000 Sound Hotel.—W. Roseveare, Sherwell Hse, Tavistock Rd, architect for Luckes and Son showrooms and offices.

Pwllheli B.C. Tender: 25 Ffordd 7 Mela houses. Clerk.

Business Prospects continued

Rotherham. Hammerson Group of Companies, Quadrex Hse, Park La, W.1, plan redevelopment of the Whitehall Cinema site, etc.

Shotley Bridge. J. M. Angus, 3 Gallowgate, Newcastle. Architect for Victory Club additions.

Shrewsbury B.C. Tender: 67 dwellings, garages and shop at Ditherington. Surveyor. —12 flats, 12 three-storey houses and a shop at New St. Clerk.

Slough. N.W. Hospital Board. Tender: Wexham Park Hospital. Architects: Powell and Moya, 36 Gt Smith St, S.W.1.

Solihull. Harry W. Weedon and Ptnrs., 45 Calthorpe Rd, Edgbaston, Birmingham, architects for Norwich Union Insurance Society's shopping centre scheme.

Southampton B.C. Tender: three contracts; B353, 20 houses, Surrey Hse; B342 17 houses Bitterne Rd; B343 three blocks 14 flats, Bitterne Rd; Engineer.

S. Shields. Newcastle Hospital Board Tender: X-ray dept., Ingham Infirmary. Architects, S. W. Milburn and Ptnrs, 9 Esplanade, Sunderland.

Stoke-on-Trent. T.C. plans traffic light installation, Liverpool Rd, etc.

Teddington. F. Coyle and Co., 61 High St, Brentford, contractors of rebuilding of Russell Bros. Ltd., Park St factory.

Wakefield. Kay, Hartley and Waite, 4 Crown Court, Wakefield, architects for new Bective Mills canteen for Harrap Bros. —Ardin and Brookes and Ptnrs., 129 Mount St, W.1, architects for shop and offices scheme on Corn Exchange site by Metrovincial Properties, 15a Hay Hill, W.1.—Kay, Hartley and Waite, 4 Crown Ct, architects, for 7-storey block, Northgate.

Wallingford. Associated British Maltsters, 58 Mark La, E.C.3, plan expansion of grain silo buildings.

Wallsend-on-Tyne. Victory Products, Church Bank, plan Limekiln Rd factory building.

W. Bromwich. Lovell and Hanson plan Oldbury Rd canteen building.—C. E. M. Fillmor, 20 Watrloo St, Birmingham, architect for S. and J. Lawley Ltd., Sans La boiler hse and Lovell and Hanson Ltd. canteen building, and J. B. and S. Lees Ltd., Albion Rd warehouse.

Wolverhampton. Rotamix Concrete Ltd plan Fox's La factory and N. C. Bishton, extensions to Dudley Rd factory.

TRADE NOTES

Change of Address. The Reading Branch of B.I.C.C. is now at Katesgrove La. Telephone: Reading 55074.

Telephone Number. The Chessington Depot of B.I.C.C. is now Lower Hook 3366/7/8.

Take-over. The manufacture and marketing of the "Win-o-Sum" fan heater has been taken over from Ashcroft Tools Ltd. by Rippingilles Ltd., Aston Rd North, Birmingham 6.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Actrol. 799,873. Class 9. AC voltage regulators incorporating semi- conductor switching devices. Westinghouse Brake and Signal Co. Ltd., 82 York Way, King's Cross, N.1.

Aerialite. 778,544, Class 6. Plates, clips, masts, cable couplings, etc. Aerialite Ltd., Castle Wks, Stalybridge, Ches.

Airelec. 803,941. Class 9. Apparatus, Airtech Ltd., Aylesbury and Thame Airport, Haddenham, Bucks.

Duroplug. 799,661. Class 9. Plugs and sockets. W. W. Haffenden Ltd., Richborough Rubber Wks, Ramsgate Rd, Sandwich, Kent.

Maximatic. 796,642. Class 7. Machines for laundering, airing, drying, washing, wringing, etc. **Monomatic.** 796,645. Class 11. Installations for lighting, heating, cooking, etc. **Hi-Cap.** 797,894 and **Magnaline.** 800,314. Class 11. Refrigerators, etc. Ada (Halifax) Ltd., West Mount Wks, Johnson St, Halifax.

Stardust. 804,706. Class 9. Apparatus, etc. Wallis Brock (ACA) Ltd., 115 Park St, W.1.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

A.F.N. (Electrical Services) Ltd., 142 The Arches, Shepherds Bush, Uxbridge Rd, W.12. To take over business carried on as "A.F.N. Electrical Service" at The Arches, W.12., etc. Nom. cap.: £100. Dirs.: Alice Northway and Arthur F. Northway.

Allegro Sound Equipment Ltd., 2 Bentinck St, W.1. Nom. cap.: £100. Dir.: Peter A. Rispoli.

Barnett's Radio and Electrical Services (Thanet) Ltd., 15 Queen St, Ramsgate. To take over business of "Barnett's Radio and Electrical Services" carried on at Ramsgate, Broadstairs and Margate, etc. Nom. cap.: £10,000. Permanent dirs.: Joseph Barnett, Samuel Barnett, Renee A. Barnett and Sybil Barnett.

Bowmen Electrical Ltd., Lex Hse, 61a South Rd, Southall, Middx. Nom. cap.: £100. Dirs.: Frederick J. Coleman, Robert R. Hawkins, Vera A. F. Green.

Circulume Ltd., 6 Tariff St, Manchester 2. Manufacturers of and dealers in electrical and electronics apparatus, etc. Nom. cap.: £100. Permanent dirs.: Charles H. Hodgson and Gordon T. Pollock.

Coldharbour Refrigeration Co. Ltd., National Provincial Bank Chmbrs, Tooting Broadway, S.W.17. Nom. cap.: £2,000. Dirs.: George A. Collins, Leslie E. Slay, Mrs Joan A. Collins and John A. Millard.

D.C.E. Electrical Industrial Ltd., Clun Wks, Howard Rd, Bromley, Kent. Nom. cap.: £100. Dirs.: Stanley V. Spear, Mrs Phyllis A. Spear and Stanley R. Spear.

East Herts Electrical Co. Ltd., 3 Market Pl, Hertford. Nom. cap.: £1,000. Dirs.: Cecil W. Cooper and Mrs Daphne F. P. P. Cooper.

A. G. Glass (Electrical Contractors) Ltd., 180 Bethnal Green Rd, E.2. Nom. cap.: £100. Dirs.: Arnold G. Glass and Shirley Glass.

Home Electrical Products Ltd., 39 Queens Rd, Coventry. Nom. cap.: £2,000. Dirs.: Arthur T. Bowring and James R. B. Park.

C. R. Jacksons (Electrical) Ltd., 4 The Crescent, Goring-by-Sea. Nom. cap.: £3,000. Permanent dirs.: Charles J. Lally and Roy J. Lally.

Modern Lighting Centre (Walthamstow) Ltd., 92 Earlham Grove, Forest Gate, E.7. Nom. cap.: £100. Dirs.: Stanley A. Ward and Rosalin Ward. Subs.: Donald E. G. Wing and William J. Reichmann.

S. J. Sneddon (Salvage Electrics) Ltd., 6 Maxwell St, Swindon. Nom. cap.: £500. Dirs.: Stanley J. Sneddon and Pamela B. Sneddon.

Squires of London Ltd. Manufacturers of and dealers in electrical and mechanical sound reproducing apparatus, etc. Nom. cap.: £20,000. Dirs.: to be appointed by subs. Subs.: Frances N. Rawden, 25 Wallace Crt, N.W.1.; Della R. Creedy, 4 Willcott Rd, W.3. (Secretary).

Vacuum and Domestic Appliances Ltd., 18 Cecil Sq, Margate, Kent. Nom. cap.: £500. Dirs.: Stanley L. Saker and Mrs M. J. Saker.

Gazette Announcements

COMPANIES ACTS

Polas Ltd. Creditors to send details to liquidator, J. D. Askew, 27 Rodney Rd, Cheltenham, Glos., by 9 Sept. Formal notice, all creditors to be paid in full.

Parker and Pilkington Ltd. Mr R. F. Bendall, 126 Colmore Row, Birmingham 3, appointed liquidator as from 4 Aug.

Marconiphone Radio and Television Sales Ltd, and "His Master's Voice" Radio and Television Sales Ltd. General meetings to be held at 146 Gt Cambridge Rd, Enfield, Middx. on 2 Sept. at 11.30 a.m. for the purpose of having an account of the liquidation laid before the members.

Davis Electrical and Radio Accessories Ltd. Resolution for voluntarily winding-up passed at meeting on 14 July. Mr L. Gibson, 14 Harley St, W.1, appointed liquidator.

Arthur and A. Cummins Ltd. G. H. Camamile, Newland Chmbrs, Beaumont Fee, Lincoln, appointed liquidator by the creditors on 4 Aug.

High Level Works (Electrical Engineers) Ltd. Meeting of members at Carlton Hse, Bull Close La, Halifax, on 30 Sept., at 3 p.m., to receive report of Mr H. W. Preston, liquidator, on winding-up.

John V. Barke Ltd. Liquidator: S. O. Henry, 5 Rumford Pl, Chapel St, Liverpool, released from 3 Aug.

BANKRUPTCY ACTS

Receiving Orders

Blackpool. William Jones, dealer in electrical appliances, 1 Mount St, Blackpool. Receiving order dated 15 Aug.

Leeds. Sydney Vary, electrical dealer, 13 Alexandra Rd, Leeds. Receiving order dated 17 Aug.

York. K. S. Cotton, trading in copartnership as Flaxley Radio Service, 9 Gowthorpe, Selby. Receiving order dated 15 Aug.

Appointment of Trustees

Oldham. F. Ward and B. Bolton, electrical goods retailers, carrying on business as Ward's Electrics at 64 Bottom 'o th' Moor and 106 Glodwick Rd and lately at 18 Huddersfield Rd, Oldham. Mr L. H. Shipton, 31 Lloyd St, Manchester 2, appointed trustee as from 5 Aug.

Stockport. T. W. Smith, domestic appliance manufacturer and dealer, formerly carrying on business as Stockport Domestic Appliances and in partnership as Delta Eng. at 94 Lancashire Hill, Stockport. Mr G. H. Eaves, 47 Mosley St, Manchester 2, appointed trustee as from 8 Aug.

Guildford. G. R. Jacobs and C. J. Trevethan, trading as Dawn Electrical Appliances, 192 Stoughton Rd, Guildford. Trustee: W. H. Hudson, 6-7 Lea Pale Rd, Guildford, appointed 16 Aug.

Intended Dividends

Cheltenham. W. Worboys, formerly trading as Cambrian Electrical Services, Longford Garage, Tewkesbury Rd, Longford. Last day for receiving proofs: 7 Sept. Trustee: G. W. Sisman, 26 Baldwin St, Bristol 1.

Halifax. L. Filby and G. D. Brown, radio, TV and electrical engineers, lately of 44 Park St, Brighouse. Last day for receiving proofs: 3 Sept: Trustee: J. L. Williams, 20 North Parade, Bradford 1.

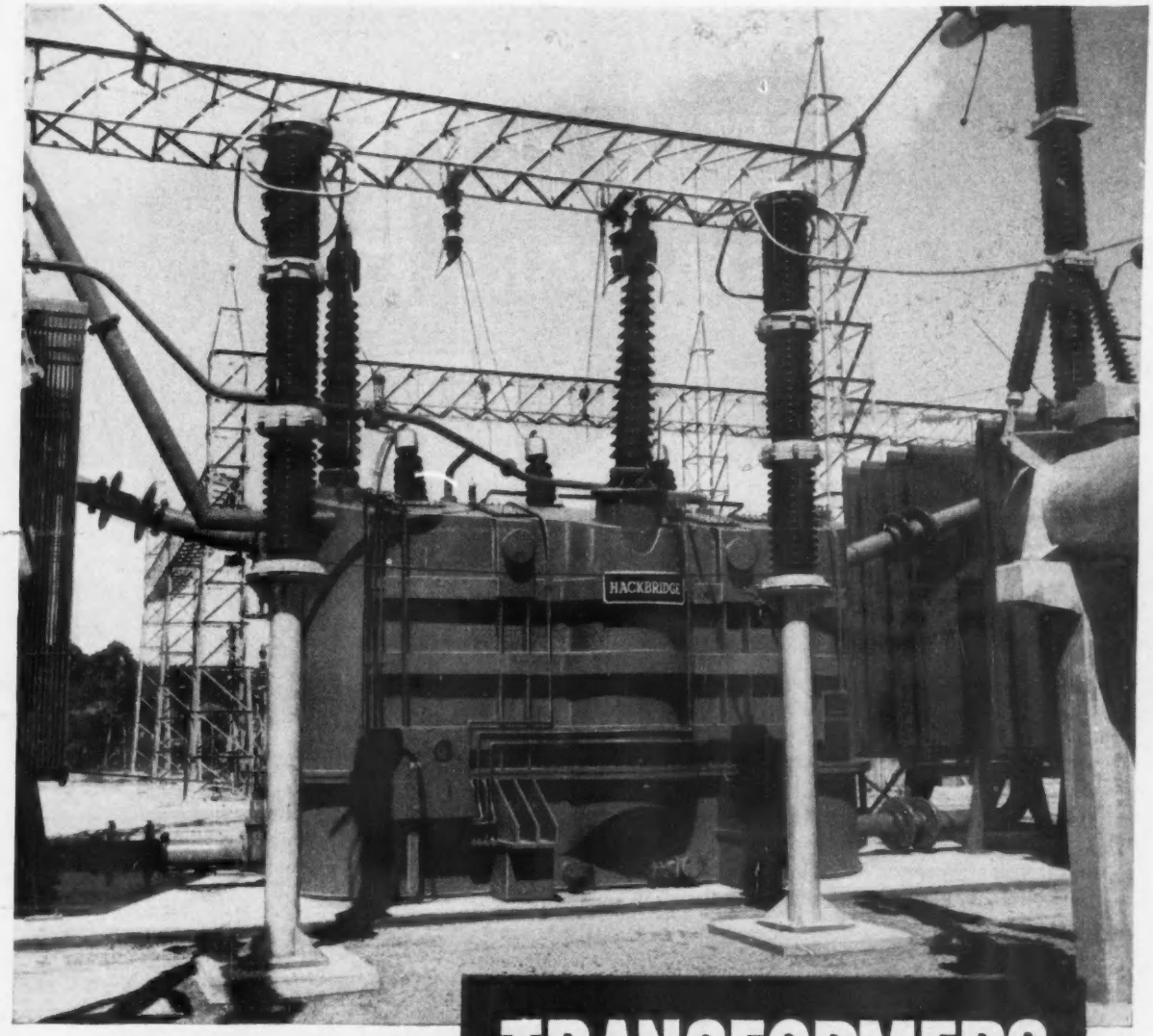
MEETINGS TO NOTE

FRIDAY, 2 SEPTEMBER

A.S.E.E. (Liverpool Branch). Chairman's address, L. Harper. Industrial Development Centre, M.A.N.W.E.B., Paradise St, Liverpool 1. 7.30 p.m.

MONDAY, 5 SEPTEMBER

21st Flying Display and Exhibition at Farnborough until 11 September.



One of three 100 MVA 220/110 KV Hackbridge transformers installed at the Chapel Street substation, Hobart, Tasmania Hydro Electric Commission.

TRANSFORMERS *BY* HACKBRIDGE

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LIMITED
WALTON-ON-THAMES - SURREY - ENGLAND
Telephone: Walton-on-Thames 28833 (8 lines) Telegrams & Cables: "Electric, Walton-on-Thames"

OVERSEAS REPRESENTATIVES: ARGENTINA: H. R. Roberts & Cia., S.R.L. Buenos Aires. **AUSTRALIA:** Hackbridge and Hewittic Electric Co. Ltd., 171 Fitzroy Street, St. Kilda, Victoria; N.S.W.: Queensland: W. Australia: Elder, Smith & Co. Ltd.; South Australia: Parsons & Robertson Ltd.; Tasmania: H. M. Bamford & Sons (Pty.) Ltd., Hobart. **BARBADOS** and surrounding islands: Electric Sales & Service Ltd., St. Michael. **BELGIUM & LUXEMBOURG:** Pierre Pollie, Brussels, 3. **BRAZIL:** Oscar G. Mors, Sao Paulo. **BRITISH GUIANA:** Dandor Commission Agency, Georgetown. **BURMA:** Neonlite Manufacturing & Trading Co. Ltd., Rangoon. **CANADA:** Hackbridge and Hewittic Electric Co. of Canada Ltd., Montreal; The Northern Electric Co. Ltd., Montreal, etc. **CEYLON:** Envee Esq Ltd., Colombo. **CHILE:** Sociedad Importadora del Pacifico Ltda., Santiago. **EAST AFRICA:** G. A. Neumann Ltd., Nairobi. **EGYPT:** Giacomo Cohenca Fils, S.A.E., Cairo. **FINLAND:** Sahko-ja Konelliike O.Y. Hermes, Helsinki. **GHANA, NIGERIA & SIERRA LEONE:** Glyndova Ltd. **GREECE:** Charilaos C. Coroneos, Athens. **INDIA:** Steam & Mining Equipment (India) Private Ltd., Calcutta; Easun Engineering Co. Ltd., Madras, 1. **IRAQ:** J. P. Bahoshy Bros., Baghdad. **MALAYA, SINGAPORE & BORNEO:** Harper, Gilfillan & Co. Ltd., Kuala Lumpur. **NETHERLANDS:** J. Kater, E.O., Ouderkerk a.d. Amstel. **NEW ZEALAND:** Richardson, McCabe & Co Ltd., Wellington, etc. **PAKISTAN:** The Karachi Radio Co., Karachi, 3. **SOUTH AFRICA:** Arthur Trevor Williams (Pty.) Ltd., Johannesburg, etc. **CENTRAL AFRICAN FEDERATION:** Arthur Trevor Williams (Pty.) Ltd., Salisbury. **THAILAND:** Vichien Phanich Co. Ltd., Bangkok. **TRINIDAD & TOBAGO:** Thomas Peake & Co., Port of Spain. **TURKEY:** Dr. H. Salim Oker, Ankara. **URUGUAY:** Ciuna Ltda., Montevideo. **U.S.A.:** Hackbridge and Hewittic Electric Co. Ltd., P.O. Box 234, Pittsburgh 30, Pennsylvania. **VENEZUELA:** Oficina de Ingenieria Sociedad Anonima, Caracas

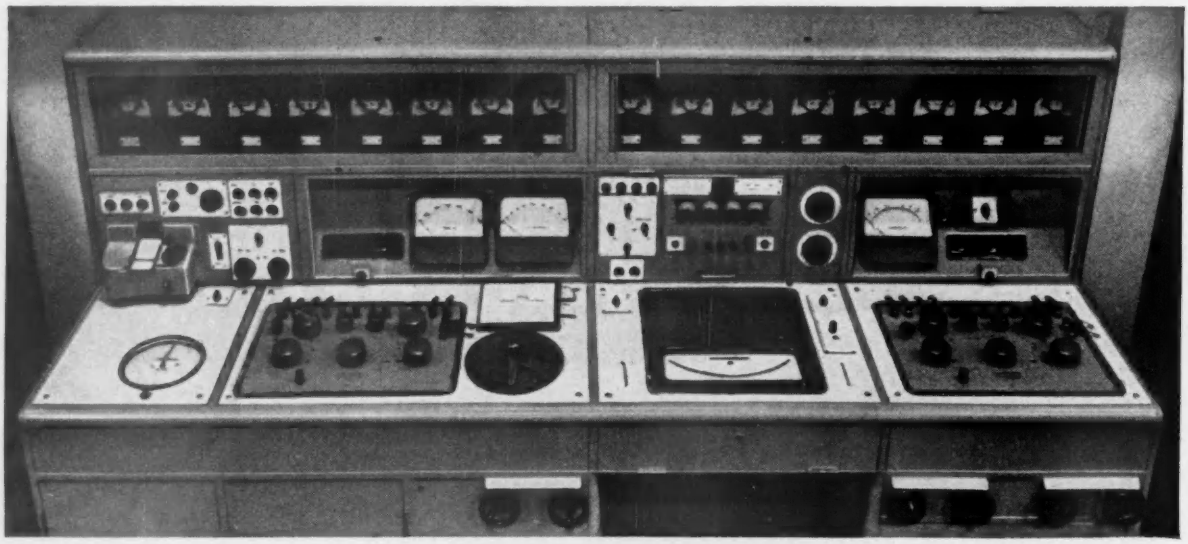
G

SETTING THE STANDARD

MODEL S 200 STANDARDISATION EQUIPMENT

The Standardisation Bench is the heart of the electronic testing equipment which ensures extreme accuracy of calibration of all S 200 meters. A Laboratory Standard Wattmeter and a crystal controlled electronic timer, reading to 1/10th of 1 millisecond, are used for the daily checking of the Rotating Standard. d.c. potentiometers are installed for the regular checking of the Laboratory Standard Wattmeter.

A large Rotating Standard dial presents the average speed of 4 very closely checked Standard Meters. Separate sets of four Standard meters being maintained for each of the various frequency ranges in which meters are supplied. The Standardisation Bench is used to check the Master Meter in each control unit in the final calibration line.



Electronically controlled Standardisation Bench.

sangamo

MODEL S 200-7 SINGLE PHASE WATTHOUR METER

SANGAMO WESTON

Years ahead of its time!

SANGAMO WESTON LTD · ENFIELD · MIDDX · ENGLAND · Tel: Enfield 3434 (6 lines) & 1242 (6 lines) · Grams: Sanwest, Enfield.

SW/90

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

TENDER

Tenders are invited for the supply of:

TRANSFORMER

Specifications may be obtained on writing to the Purchasing Officer, Trinidad and Tobago Electricity Commission, P.O. Box 121, Port-of-Spain, Trinidad, W.I.

Closing date for Tenders: 15 Oct., 1960. (R 784)

BOROUGH OF WREXHAM
Groups "A" and "B" Street Lighting
Scheme No. 4

FIXED priced tenders are invited for the supply and delivery and erection of Street Lighting Columns, Brackets, Lanterns and Lamps.

Conditions of Contract may be inspected at the office of the Borough Engineer and Surveyor, 31 Chester St, Wrexham, from whom copies of the Specification, Bill of Quantities and forms of Tender may be obtained.

Tender to be delivered in a plain envelope, sealed and endorsed "Street Lighting Scheme No. 4" to the undersigned not later than 12 noon on Friday, 9 Sept., 1960.

PHILIP J. WALTERS,
Town Clerk.

Guildhall,
Wrexham.
Aug., 1960. (R 708)

APPOINTMENTS VACANT

MAURITIUS CENTRAL ELECTRICITY BOARD

ASSISTANT ENGINEERS

APPLICATIONS are invited for the posts of Assistant Engineer at a salary according to experience and qualifications in scale equivalent to £675 rising £1,130 per annum.

For Mauritian candidates now resident outside the Colony, the posts offer possibility of permanent and pensionable employment.

Overseas candidates would be on contract for three years in first instance. Housing allowance £180 per annum. Free passages for officer, wife and up to two children. Liberal leave on full salary. Gratuity £200 per annum whilst serving on temporary terms.

Candidates should have had experience in distribution of electricity, preferably with a public electricity supply undertaking, and must possess H.N.C. in Electrical Engineering or equivalent.

Full professional qualifications (A.M.I.E.E.) an added advantage. Write to the CROWN AGENTS, 4 Millbank, London S.W.1. State age, name in block letters, qualifications and experience and quote M2A/51119/EE. (R 749)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Edinburgh and Borders Area

(1) INSTALLATION ENGINEER
EDINBURGH EAST DISTRICT
(2) THIRD ASSISTANT DISTRICT ENGINEER
EDINBURGH NORTH DISTRICT

APPLICATIONS are invited for the above appointments. Applicants should have had a sound engineering and technical training and possess the minimum qualification of the National Certificate in Electrical Engineering. Salary and conditions of service for both of these appointments will be in accordance with the National Joint Board agreement, Class G, Grade 9 (Scale £965 to £1,090 p.a.). The posts will be superannuable. The installation engineer should have a good knowledge of the organisation and operation of a contracting department, including estimating and costing, and be familiar with domestic, commercial and industrial installation work. The Third Assistant Engineer should have a sound training and subsequent experience with H.D. and L.V. underground distribution system, including the operation and maintenance of H.V. and L.V. switchgear and cables. A knowledge of protective gear and fault location is also required. Applications on the standard form should be submitted to the undersigned not later than 12 Sept., 1960.

C. H. A. COLLYNS,
Manager.

52 Melville St,
Edinburgh 3. (R 783)

YORKSHIRE ELECTRICITY BOARD
No. 7 (Grimsby) Sub-Area

GAINSBOROUGH DISTRICT
ASSISTANT CONSUMERS' ENGINEER
(GENERAL DEVELOPMENT)

THE successful applicant will be responsible to the Consumers' Engineer for the day-to-day control of Service Centre and Sales Staff.

Salary: N.J.B. Class E, Grade 10 transitional £645/£735 to Scale 4, £765/£870 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 9 Sept., 1960.

No. 4 (Leeds) Sub-Area

DEMONSTRATOR (FEMALE)
LEEDS

Applicants should have completed a full-time course in Domestic Subjects at a recognised Training College and preferably possess the Certificate of the Electrical Association for Women. They should be experienced in demonstrating appliances, particularly cookers, and be capable of giving public demonstrations and advising Consumers on the use of electricity in the home.

Previous experience in the Electricity Supply Industry will be an advantage.

Salary: N.J.C.1, £600 x £25—£700 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, Leeds, not later than 9 Sept., 1960. (R 789)

CENTRAL ELECTRICITY GENERATING BOARD
South Eastern Division

Vacancy No. 150A/60T.
FOURTH ASSISTANT ENGINEER
(OPERATION AND MAINTENANCE)
NORTHFLEET DISTRICT

REQUIRED for Operation and Maintenance work on 275 and 132 kV overhead lines, cables, transformers, switchgear, etc. Candidates should possess H.N.C. or equivalent qualifications and experience on similar equipment will be an advantage. N.J.B. Conditions of Service and salary Class AX, Grade 11, £905/£1,140 per annum with prospect of promotion to Grade 9, £1,055/£1,295 per annum including London Allowance, subject to satisfactory service.

Applications, quoting Vacancy No. and giving age, details of previous experience, qualifications, etc., should be sent to the Personnel Officer, South Eastern Division, Lower Ham Rd, Kingston upon Thames, to arrive by 1 Sept., 1960. (R 779)

AIR MINISTRY
Works Designs Branch

REQUIRES in London and Provinces ENGINEERING DESIGNER DRAUGHTSMEN experienced in preparation of schemes for illumination and electrical equipment of buildings or schemes for H.V. and M.V. electrical distribution. Candidates should have served a recognised apprenticeship or had equivalent training and also have had practical experience. O.N.C. an advantage. Financial assistance and time off given for recognised courses of study. Promotion and pension prospects. Five-day week with 18 days' paid leave per year initially. Overseas tours for which special allowances granted. Salary: in London ranges from £680 (at age 25) to £900 p.a. for men; from £673 to £868 for women. Somewhat lower in Provinces. Commencing salary dependent on age, qualifications and experience. Applicants, who must be natural born British subjects, should write to Air Ministry, W.G.d., Lacon Hse, Theobalds Rd, London W.C.1, or apply to any Employment Exchange quoting King's Cross 896, giving age, details of training, qualifications, full particulars of former posts held and copies of any testimonials. Candidates selected will normally be interviewed in London and certain expenses reimbursed. (R 283)

MIDLANDS ELECTRICITY BOARD
Worcester and District Sub-Area

APPLICATIONS are invited for the following superannuable posts:

SECOND ASSISTANT DISTRICT ENGINEERS
(REDDITCH/BROMSGROVE DISTRICT)

Experience necessary in all branches of distribution work including construction, maintenance and operation of high and low voltage underground and overhead systems and substations, and the planning of system reinforcements and mains extensions. Technical qualifications desirable. Salary: £1,115/£1,245 per annum (N.J.B. Grade G.7). Apply, by letter, within 14 days, stating age, experience, present position and salary, to District Manager, Midlands Electricity Board, Windsor Rd, Redditch, Worcs.

THIRD ASSISTANT ENGINEER (CIVIL)
(BUILDING SECTION) (HEADQUARTERS)

Duties will include the design and supervision of alterations to Service Centres, civil works and switch houses associated with 66 and 33 kV outdoor substations. Knowledge of modern building methods essential. Technical qualifications desirable. Salary: £1,115/£1,245 per annum (N.J.B. Grade K.10). Apply, by letter, within 14 days, stating age, qualifications, experience, present position and salary to Mr R. Mallet, Sub-Area Manager, Midlands Electricity Board, P.O. Box 52, Blackpole Rd, Worcester.

F. W. CATER,
Secretary.
(R 787)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointment:

DEPUTY STATION SUPERINTENDENT
WEST THURROCK GENERATING STATION
(ESSEX)

Salary: N.J.B., Class M, Grade 2, Scale 19, £2,225/£2,455 per annum, inclusive of London Weighting.

Applicants should be members of one or more of the recognised Engineering Institutions and have had experience in the operation, maintenance and management of modern Generating Plant.

Applications on Form AE6/ACT should be forwarded to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts., not later than 3 Sept., 1960. (R 765)

COUNTY BOROUGH OF SOUTHAMPTON
Borough Engineer and Surveyor's Department

TEMPORARY CLERK OF WORKS
(ELECTRICAL)

REQUIRED immediately in connection with the Council's housing programme. Salary: £14 10s 8d per week.

Applicants should have served an indentured apprenticeship in the Electrical Contracting Industry, with good experience in the supervision of all types of modern electrical installations.

Applications on forms obtainable from the Borough Engineer and Surveyor, Civic Centre, Southampton, returnable by not later than Monday, 5 Sept., 1960. (R 682)

ELECTRICITY BOARD FOR NORTHERN IRELAND

APPLICATIONS are invited for appointment as

ASSISTANT SHIFT CHARGE ENGINEER

at the Board's Power Station, Coolkeeragh, County Londonderry.

Candidates should have had a sound technical training and experience in modern power station plant operation.

Preference will be given to candidates with Degree or Higher National Certificate or equivalent in Electrical and/or Mechanical Engineering.

Membership of the Electricity Board (Northern Ireland) Superannuation Fund will be a condition of the appointment.

Applications, which should set out concisely age, education, degrees and/or qualifications and details of practical experience, should be addressed to the Secretary of the Board at their Head Office, P.O. Box 2, Danesfort, 120 Malone Rd, Belfast 9.

Original testimonials should not be forwarded. (R 755)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointment at Divisional Headquarters (Cockfosters in North London):

THIRD ASSISTANT ENGINEER—
GENERATION DEPARTMENT
(OPERATIONAL RESEARCH)

Salary: N.J.B., Class AX, Grade 8, Scale 10, £1,155/£1,375 per annum inclusive of London Weighting.

Duties include the investigation of problems concerning the efficiency, economy and plant availability of Electrical Generation equipment.

Applicants should have a good knowledge of the Industry and have Higher National qualifications or the equivalent. Previous investigational experience is desirable, and evidence of an inquiring mind and of an aptitude for logical reasoning is important.

Applications, quoting Reference S.V. No. 1311, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 3 Sept., 1960. (R 750)

YORKSHIRE ELECTRICITY BOARD

APPOINTMENT OF CHIEF ENGINEER

APPLICATIONS are invited for the position of Chief Engineer to the Board at a salary range of £3,750/£4,250 per annum, to succeed Mr J. D. Nicholson, B.SC., M.I.E.E.

Applicants must be fully qualified Electrical Engineers with a wide experience of electricity supply and have held a senior position in a large-scale organisation.

Applications should be returned to The Secretary, Yorkshire Electricity Board, Wetherby Rd, Scarcroft, Leeds, not later than Monday, 12 Sept., 1960. (R 774)

ELECTRICITY BOARD FOR NORTHERN IRELAND

APPLICATIONS are invited for appointment as

INSTRUMENT TECHNICIAN

at the Board's Power Station, Coolkeeragh, County Londonderry.

Candidates should have had a sound technical training and have a good practical knowledge of the construction, repair and testing of power station instruments and automatic controls. The possession of a Higher National Certificate or equivalent in Electrical Engineering would be an advantage.

Membership of the Electricity Board (Northern Ireland) Superannuation Fund will be a condition of the appointment.

Applications, which should set out concisely age, education, qualifications and details of practical experience, should be addressed to the Secretary of the Board at their Head Office, P.O. Box 2, Danesfort, 120 Malone Rd, Belfast 9.

Original testimonials should not be forwarded. (R 754)

CITY OF SALISBURY
Southern Rhodesia

VACANCY FOR SENIOR ELECTRICAL
ENGINEER (INSTALLATION)

SALARY SCALE:

£1,768 2s 6d x £51 5s—£1,921 17s 6d

APPLICATIONS are invited for the fixed establishment post of Senior Electrical Engineer (Installation) in the Salisbury Municipal Electricity Department, on the above scale, commencing salary at the minimum of the grade. No cost of living or other allowances are payable.

Candidates must be corporate members of the British Institution of Electrical Engineers and/or hold an equivalent electrical engineering degree.

The post requires experience in the general application of electricity to industrial, commercial and domestic premises, the preparation of estimates for and planning of such installations, general knowledge of Electricity Regulations, and the commissioning and maintenance of electrical plant and installations. The successful candidate will serve in the Consumers' Engineer's Section as assistant to the Installation Engineer.

The appointment will be subject to the City Council's Service and Leave Regulations. The successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months and if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities' Joint Pension and Widows' and Orphans' Fund. He must also be able to comply with the requirements of the Federal Immigration Authorities.

Candidates must submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received. Age, place of birth, nationality and marital state should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Davis and Soper Ltd., 52-54 St. Mary Axe, London E.C.3, to whom applications must be submitted on or before 10 Sept., 1960. (R 676)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

DEMONSTRATOR

REQUIRED in the Liverpool South District of the Board's No. 1 Sub-Area.

Salary within range £600/£700 per annum (N.J.C. Grade 1), according to qualifications and experience.

Applicants should possess a recognised diploma in Domestic Science, or other approved qualification, and should preferably have had training and experience in the demonstration and use of domestic electrical appliances.

Appointment subject to medical examination. Pension Scheme.

Applications, stating age, experience, etc., should be forwarded to the Manager, No. 1 Sub-Area, 24 Hatton Gdn, Liverpool 3, not later than 5 Sept., 1960. (R 752)

HAYES & HARLINGTON U.D.C.

ELECTRICAL/MECHANICAL
ASSISTANT ENGINEER

APPLICATIONS are invited for the above permanent appointment. Salary within range £785/£1,070 plus appropriate London Weighting. Candidates should be appropriately qualified and have had suitable training and experience (not necessarily in local government). Duties include electrical/mechanical work for buildings, vehicles and plant. Five-day week. Further particulars, conditions, form of application from the undersigned, to whom completed applications must be returned by 5 Sept., 1960.

GEORGE HOOPER,
Clerk and Solicitor.

Town Hall,
HAYES, Middx.

(R 683)

CENTRAL ELECTRICITY GENERATING BOARD
London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A and B. Salary includes London Allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. an advantage.

FOURTH ASSISTANT ENGINEER
PLANT AND DEVELOPMENT SECTION
ELECTRICAL DEPARTMENT
DIVISIONAL HEADQUARTERS
GENERATION HOUSE
Vacancy No 60/707.

Experience in manufacture and testing of electrical equipment used in power stations and on high voltage transmission systems. Commissioning or maintenance experience of such plant including protective gear is an advantage. Salary: Class TSBX, Grade 11, £905/£1,215 from 1 July, 1960, to £950/£1,215 per annum from 1 July, 1961.

MAINTENANCE SUPERINTENDENT
BRUNSWICK WHARF POWER STATION
Vacancy No. 60/708.

Applicants for this post should have administrative experience in co-ordinating the services of Mechanical, Electrical and Instrument Maintenance Departments in a station of advanced design. Knowledge of National Agreements and Statutory requirements are essential. Experience in the preparation of projects and budgetary procedures would be an advantage. Salary: Class K, Grade 4, £1,710/£1,890 per annum.

Applicants to vacancy 60/494 advertised on 14 July, 1960, need not re-apply, as they will be reconsidered.

Applications, quoting Vacancy No. to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box 136, London W.1, by 6 Sept., 1960. (R 764)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

CENTRAL ELECTRICITY GENERATING BOARD
East Midlands Division

DEPUTY STATION SUPERINTENDENT
COVENTRY POWER STATION
Vacancy No. 200/60.

APPLICANTS should preferably be Corporate Members of the Institution of Electrical Engineers and/or the Institution of Mechanical Engineers, and experience in the efficient combustion of fuels on Chain Grate Stokers would be an advantage.

A wide knowledge of the operation and maintenance of a modern generating station and sound administrative and organising ability are essential.

The salary will be within Class G, Grade 3 (£1,440/£1,610 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 9 Sept., 1960.

This appointment will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent, and should be returned to the Station by the date stated.

ASSISTANT SHIFT CHARGE ENGINEER
NORTH WILFORD POWER STATION
Vacancy No. 201/60.

Applications are invited for the position of Assistant Shift Charge Engineer at North Wilford Power Station, Queens Drive, Nottingham.

Applicants should preferably possess the Higher National Certificate or its equivalent, and have had responsible experience in the operation of modern Power Station plant. Pulverised Fuel experience will be an advantage.

Salary for the appointment will be in accordance with Class K, Grade 8 (£1,275/£1,410 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 9 Sept., 1960.

ASSISTANT SHIFT CHARGE ENGINEER
COVENTRY POWER STATION
Vacancy No. 202/60.

Applications are invited for the position of Assistant Shift Charge Engineer at Coventry Power Station, Alderman's Green, Coventry.

Applicants are required to take charge of shift operation of Boiler House plant and must possess a sound technical training, a good general engineering experience, and knowledge of the control and operation of water tube boilers, ancillary plant and the efficient combustion of fuels and Chain Grate Stokers.

Salary will be in accordance with Class G, Grade 9 (£965/£1,090 per annum) of the National Joint Board Agreement, plus 10% shift enhancement.

Closing date for receipt of applications: 9 Sept., 1960.

ASSISTANT MAINTENANCE ENGINEER
(ELECTRICAL)
COVENTRY POWER STATION
Vacancy No. 203/60.

Applications are invited for the position of Assistant Maintenance Engineer (Electrical) at Coventry Power Station, Alderman's Green, Coventry.

Applicants should have received a thorough technical and practical training, with experience in testing protective gear, maintenance of alternators, transformers, switchgear and associated equipment.

Preference will be given to candidates who hold a recognised qualification.

Salary will be in accordance with Class G, Grade 8 (£1,040/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 9 Sept., 1960.

FOURTH ASSISTANT ENGINEER
COVENTRY SECTION
Vacancy No. 204/60.

Applications are invited for the position of Fourth Assistant Engineer at Coventry Transmission Section, Victoria Mills, Bulkington, nr. Nuneaton.

continued in next column

continued from previous column

Applicants should have experience of maintenance and operation of E.H.T. overhead lines, transformers and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

The salary will be in accordance with Class BX, Grade 11 (£855/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 9 Sept., 1960.

SHIFT CHARGE ENGINEER
COVENTRY POWER STATION
Vacancy No. 198/60.

Applications are invited for the position of Shift Charge Engineer at Coventry Power Station, Alderman's Green, Coventry.

Applicants should have had a sound technical training and practical experience in the operation of steam generating plant and main switchgear. An apprenticeship and technical qualifications would be an advantage.

Salary will be in accordance with Class G, Grade 7 (£1,115/£1,245 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 2 Sept., 1960.

PLANT CONTROL ENGINEER
DRAKELOW "B" POWER STATION
Vacancy No. 199/60.

Applications are invited for the position of Plant Control Engineer at Drakelow "B" Power Station, Drakelow, nr. Burton-on-Trent.

Experience desirable in control of Boilers and Turbines at high pressure and temperature, pulverised fuel together with electrical control room experience.

Technical qualification to H.N.C. desirable.

Salary will be in accordance with Class L, Grade 10 (£1,190/£1.325 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 2 Sept., 1960.

GENERAL ASSISTANT ENGINEER
(CHEMIST)
STAYTHORPE POWER STATION
Vacancy No. 205/60.

Applications are invited for the position of General Assistant Engineer (Chemist) at Staythorpe Power Station, Staythorpe, nr. Newark.

Candidates must have had a sound technical training and previous laboratory experience and should preferably hold the Higher National Certificate in Chemistry, but consideration will be given to candidates studying for that qualification.

The salary will be in accordance with the National Joint Board Agreement and will be within the range £625/£805 per annum.

Closing date for receipt of applications: 9 Sept., 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent or Section Engineer concerned, and should be returned to the Station by the date stated.

O. S. WOODS,
Divisional Controller.
(R 795)

THE NORTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT DISTRICT
COMMERCIAL ENGINEER
(TECHNICAL SALES AND SERVICE)
NORTH WEST DISTRICT, ECCLES

APPLICANTS should be capable of handling enquiries on Industrial and Commercial Tariff matters and giving electro-technical advice to Industrial and Commercial consumers on the most economical and efficient utilisation of electricity.

Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

continued in next column

continued from previous column

Salary Scale: £1,115/£1,245 p.a. Grade G.7. N.J.B. Conditions.

Application Forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 6 Sept., 1960.

FOURTH ASSISTANT DISTRICT
COMMERCIAL ENGINEER
(TECHNICAL SALES AND SERVICE)
WIGAN DISTRICT

The successful applicant will be required to assist the Technical Sales and Service Engineer in connection with Industrial and Commercial Tariff matters. The duties will include the preparation of space heating schemes and the giving of advice to consumers on the most efficient and economical utilisation of electricity. Technical qualification to Higher National Certificate standard desirable.

Salary scale: £715/£805 p.a., Grade G.13. N.J.B. conditions.

Application forms to be obtained from the Manager, No. 2 Sub-Area, The North Western Electricity Board, 2 St. George's Rd, Bolton, and returned to him by 6 Sept., 1960.

THIRD ASSISTANT DISTRICT ENGINEERS
(a) OLDHAM DISTRICT
(b) STOCKPORT DISTRICT

The duties will include assisting in the operation, construction and maintenance of the overhead and underground distribution system, including substations up to 33 kV. The successful applicant will be required to undertake standby duties. Preference will be given to applicants who hold the H.N.C. in Electrical Engineering.

Salary scales:
Post (a) £1,040/£1,165 p.a. Grade H.9.
Post (b) £965/£1,090 p.a. Grade G.9.
N.J.B. Conditions.

Application forms to be obtained from the Manager, No. 3, Sub-Area, The North Western Electricity Board, Union St, Oldham, and returned to him by 6 Sept., 1960.
(R 751)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

SHIFT CHARGE ENGINEER

REQUIRED at the Wolverhampton Power Station. N.J.B. Service Conditions, superannuable appointment, salary within Schedule A, Grade E.7, £965/£1,090 per annum, plus 10% shift allowance and a further £50 for load control duties.

Applicants should have a sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear. Appropriate qualifications desirable.

Apply, quoting Vacancy Number 225/60MD on Form AE6, to the Station Superintendent, Wolverhampton Power Station, Commercial Rd, Wolverhampton. Closing date for receipt of applications is 5 Sept., 1960.
(R 800)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

FIRST ASSISTANT STATION CHEMIST

REQUIRED for Nechells "A" and "B" Power Stations. N.J.B. Service Conditions, superannuable appointment, salary within Schedule A, Grade K9, Scale 10, £1,190/£1,325 per annum.

Previous experience in a Power Station Laboratory is essential, and candidates should preferably possess the A.R.I.C., but those holding the H.N.C. will be favourably considered. Applicants should be familiar with sampling and analysis of coal, water and oil and with the application of the results. Duties will include assisting the Station Chemist in the provision of a satisfactory chemical service to the Stations.

Apply, quoting Vacancy Number 220/60MD on form AE6, available from the Station Superintendent, Nechells "A" and "B" Power Stations, off Aston Church Rd, Nechells, Birmingham 7. Closing date for receipt of applications is 9 Sept., 1960.
(R 801)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

SUB-AREA HEADQUARTERS, BEDFORD
ASSISTANT (ESTATES AND WAYLEAVES)
SECRETARIAL DEPARTMENT
220/60.R.

Candidates should have administrative ability as the duties will include work resulting from the operations of staff in obtaining substation sites, and work relating to statutory consents.

Salary: N.J.C. Grade 3 (£780/£880).

Apply by letter to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend St, Bedford, by 9 Sept., 1960.

Essex Sub-Area

SUB-AREA HEADQUARTERS
Nr. BRENTWOOD
(a) FOURTH ASSISTANT ENGINEER
(CONSTRUCTION)
222/60.R.
(b) FOURTH ASSISTANT ENGINEER
(CIVIL)
221/60.R.

Candidates for (a) should have had experience in supervising the erection of overhead lines and the laying and jointing of H.V. underground cables.

Candidates for (b) should have received a technical education to Higher National Certificate level in building and should possess a sound knowledge of building construction with experience in the preparation of specifications, bills of quantities, estimates, contracts, and the settlement of accounts in connection with new building and maintenance of properties.

Salary: N.J.B. Class L, (a) Grade 12 (£1,040/£1,165); (b) Grade 13 (£965/£1,090). Plus London Allowance.

For these appointments apply by letter to G. M. Holland, M.I.E.E., A.M.B.I.M., Engineer, Essex Sub-Area, Eastern Electricity Board, Millfield, Bentley, nr. Brentwood, Essex, by 9 Sept., 1960.

Northmet Sub-Area

SUB-AREA HEADQUARTERS, N.14
WAYLEAVE ASSISTANT
DEVELOPMENT SECTION
ENGINEER'S DEPARTMENT
(Ref. 961) 219/60.N.

Candidates should have had a good education and be experienced in negotiations with owners of properties for the acquisition of substation sites and the obtaining of Wayleaves.

Ability to assess and deal with agricultural and other damage claims is desirable.

Salary: N.J.C. 3 (£780/£880) plus London Allowance.

Apply by letter to the Manager, Eastern Electricity Board, Northmet Sub-Area, Northmet Hse, Southgate, London N.14, by 5 Sept., 1960.

HERTFORD DISTRICT
THIRD ASSISTANT ENGINEER
(Ref. 942) 224/60.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems including substations.

Salary: N.J.B. Class G, Grade 9 (£965/£1,090).

Apply by letter to W. H. Hatton-Ward, ASSOCIATE I.E.E, A.M.B.I.M., Manager, Eastern Electricity Board, Bridgefoot, Ware, Herts, by 5 Sept., 1960.

WEMBLEY DISTRICT
SENIOR SALES REPRESENTATIVE
(Ref. 990) 225/60.R.

Candidates should have had a sound training and experience in a Commercial Department of the Electrical Industry and be capable of estimating for and supervising installation work. A knowledge of space heating, water heating and tariffs is essential.

Salary: N.J.C. Grade 2 (£700/£775) plus London Allowance.

Apply by letter to F. H. Long, M.I.E.E., M.AMER.I.E.E, Manager, Eastern Electricity

continued in next column

continued from previous column

Board, Kingsbury Rd, Kingsbury N.W.9, by 5 Sept., 1960.

WOOD GREEN DISTRICT
SECOND ASSISTANT ENGINEER
(Ref. 1002) 223/60.R.

Candidates should have had a sound technical training and considerable experience in the construction, operation and maintenance of underground distribution systems at voltages up to and including 33 kV.

Salary: N.J.B. Class F, Grade 7 (£1,040/£1,165) plus London Allowance.

Apply by letter to R. A. Voit, M.I.E.E., Manager, Eastern Electricity Board, 13-27 Station Rd, Wood Green, London N.22, by 5 Sept., 1960. (R 792)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 217/ET/60

APPLICATIONS invited for superannuable N.J.B. appointment of ASSISTANT MAINTENANCE ENGINEER (ELECTRICAL) at Tir John Power Station, Port Tennant, Swansea.

Salary: Class H, Grade 9, Scale 8, £1,040/£1,165 per annum.

Applicants should possess H.N.C. or equivalent qualifications and should have had wide experience in Power Station electrical maintenance.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 9 Sept., 1960. (R 766)

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)

HESTON District of No. 1 (Southall) Sub-Area. Salary: N.J.B. Class G, Grade 9 (£1,015/£1,140 per annum, inclusive of London Allowance). N.J.B. Conditions of Service.

The duties of the post will be to assist with the maintenance and operation of switchgear, transformers, auxiliary gear and underground cables up to and including 11 kV. The appointment will involve standby duties.

The successful applicant will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2-6 Windmill La, Southall, Middlesex, and returned to him, quoting Z.1197, not later than 5 Sept., 1960. (R 794)

SOUTH EASTERN ELECTRICITY BOARD

CARTOGRAPHIC DRAUGHTSMAN
DORKING AND EPSOM DISTRICT

SALARY: £700 x £25—£775 p.a. under N.J.C., Grade 2. Superannuable. Applicants should have experience in the preparation of mains record plans, reproduction of Ordnance Survey maps and general drawing office routine. Applications, quoting ET and naming two referees, to District Manager, Seeboard, 56 South St, Dorking, by 7 Sept., 1960.

ASSISTANT DISTRICT ENGINEER
BRIGHTON AND HOVE DISTRICT

Salary: £1,040 x £25—£1,165 under N.J.B. Class H, Grade 9 (Scale 8). Superannuable. Applicants, preferably graduate members of the Institution of Electrical Engineers, should have had training and experience in the construction, operation and maintenance of underground H.V. and M.V. distribution systems up to and including 33 kV. The successful candidate will be required to undertake standby duties and a regular user's car allowance will be available if appropriate. Applications quoting ET and naming two referees to District Manager, Seeboard, Electric Hse, Castle Sq, Brighton, by 7 Sept., 1960.

GEORGE WRAY,
Secretary.
(R 799)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 219/ET/60.

APPLICATIONS invited for the superannuable N.J.B. appointment of ASSISTANT MAINTENANCE ENGINEER (MECHANICAL) at LLYNFI POWER STATION, NR. BRIDGEND, GLAM.

Schedule A, Class G, Grade 8, Scale 8 (£1,040/£1,165 per annum).

Applicants should have experience in the maintenance of heavy plant and possess H.N.C. or equivalent qualifications.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 9 Sept., 1960. (R 797)

LONDON ELECTRICITY BOARD

ENGINEERING DRAUGHTSMAN

APPLICATIONS are invited for the above position in the Board's Ravensbourne District at 293-295 Kirkdale, Sydenham, S.E.26.

Candidates should have a good general and technical education and be in possession of the Ordinary National Certificate, be neat and capable draughtsmen and be experienced in one or more of the following subjects: drawing office routine, electrical diagrams, layout of plant in transformer chambers, mains survey and recording of mains work.

Pending determination as to the grading of the post within Schedule A of the National Joint Board Agreement, the salary will be in the provisional range £755 per annum, rising to £855 per annum, inclusive of London Allowance.

Application form obtainable from the Personnel Officer at 46 New Broad St, E.C.2., to be returned completed within 14 days of the publication date of this notice. Please quote ref: PER/V/3053/T. (R 753)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

Area Board Headquarters
Chief Engineers' Department, Carliol House
Newcastle upon Tyne

THIRD ASSISTANT ENGINEER
(DRAUGHTSMAN)

Applicants should be capable of taking charge of a section in the Drawing Office. They should have had a sound technical education, practical experience in the design and layout of substations and must be thoroughly conversant with civil work, including the design and detail of reinforced concrete structures and foundations.

Salary: Schedule B, Grade AX8, £1,105/£1,325 according to qualifications. N.J.B. conditions of service.

Tees Sub-Area

TWO THIRD ASSISTANT DISTRICT ENGINEERS
STOCKTON DISTRICT

Applicants should be of H.N.C. standard in electrical engineering and have had some experience in either the design, construction or operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

Salary: Schedule A, Class G, Grade 9, £965/£1,090. N.J.B. conditions of service.

York Sub-Area

SENIOR SERVICE CENTRE ASSISTANT
(MALE)
SCARBOROUGH DISTRICT

Salary: £780/£880 in accordance with Grade 3, N.J.C. Agreement dependent on qualifications and experience in the promotion of sales of electrical appliances and display.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne, within 10 days of the appearance of this advertisement. (R 790)

COUNTY BOROUGH OF WEST BROMWICH
Public Works Department

APPOINTMENT OF ELECTRICAL TECHNICAL ASSISTANT

APPLICATIONS are invited for the above appointment at a salary in accordance with Grade A.P.T. II (£765/£880). The commencing salary will be fixed in accordance with qualifications and experience.

Candidates should be suitably qualified and experienced in the preparation of small schemes and specifications for electrical installation work, together with administration in routine maintenance.

The successful applicant will be required to control work by Direct Labour of the Electrical Section of the Public Works Department.

Applications, stating age, qualifications, present salary, position and experience, accompanied by two persons to whom reference may be made, should be delivered to the undersigned not later than 31 Aug., 1960.

W. H. GREENWOOD,
Borough Engineer and Surveyor.

Town Hall,
West Bromwich. (R 780)

EASTERN ELECTRICITY BOARD
Fens Sub-Area

ELECTRICIANS
215/60.R.

VACANCIES for electricians are occurring in the Newmarket, Cambridge, Huntingdon and St. Neots areas. Applicants should be skilled craftsmen experienced in domestic, commercial and industrial installations.

Rates and conditions in accordance with the National Joint Industrial Council Agreement for the Electricity Supply Industry, the present rate being 5s 6½d per hour for a 42-hour, five-day week

Apply by letter to the Secretarial Officer, Fens Sub-Area, Eastern Electricity Board, Milton Hall, Milton, Cambridge, by 5 Sept., 1960. (R 791)

CITY OF NOTTINGHAM EDUCATION COMMITTEE
People's College of Further Education

PRINCIPAL: W. W. DIXON, M.SC., A.R.I.C.

DEPARTMENT OF ELECTRICAL ENGINEERING

APPLICATIONS are invited for the post of ASSISTANT LECTURER for Radio Service Work and the earlier stages of Radio and Line Transmission and/or Telephony and Telegraphy.

Salary: Burnham Scale Grade A or B according to qualifications and experience.

Grade A: £520 x £27 10s—£1,000 per annum.

Grade B: £700 x £27 10s—£1,150 per annum.

Additions for training and graduate qualifications and increments for suitable industrial and/or teaching experience.

Further particulars and form of application may be obtained from the undersigned and should be returned by 5 Sept., 1960.

W. G. JACKSON,
Director of Education.

Exchange Bldgs,
Nottingham. (R 786)

NOTTINGHAM AND DISTRICT TECHNICAL COLLEGE
Burton Street, Nottingham

PRINCIPAL: D. A. R. CLARK
M.SC.(TECH.), M.I.MECH.E.

APPLICATIONS are invited for the following posts:

LECTURER IN LIGHT CURRENT ELECTRICAL ENGINEERING

LECTURER IN ELECTRICAL UTILISATION PLANT AND MACHINES

ASSISTANT LECTURER, GRADE B, IN ELECTRICAL ENGINEERING

Salaries in accordance with the Burnham Technical Scale as follows:

continued in next column

continued from previous column

Lecturer: £1,370 x £35—£1,550 per annum. A salary above the minimum will be paid in approved cases.

Assistant, Grade B: £700 x £27 10s—£1,150 per annum, plus additions for qualifications and training. Commencing salary according to previous experience.

Research encouraged. Facilities and equipment available.

Further particulars and form of application may be obtained from the Principal, to whom completed forms should be returned not later than 9 Sept., 1960. (R 788)

THE EAST MIDLANDS ELECTRICITY BOARD
Nottingham Sub-Area

THIRD ASSISTANT ENGINEER
Re-advertised Vacancy No. 13/60.

SALARY: N.J.B. Class K, Grade 11, £1,040 x £25—£1,165 per annum.

The duties will be to assist in the construction, maintenance and operation of substations and the general work of the Sub-Area Engineering Department. A knowledge of protective gear testing would be an advantage.

Applications giving details of age, present position and salary, qualifications and experience should be addressed to the Manager, Nottingham Sub-Area, 35-39 Carrington St, Nottingham, within 14 days of the date of this advertisement.

Nottingham Sub-Area

SUB-AREA ACCOUNTANT
Vacancy No. 95/60.

Salary: N.J.M. and H.E.G.C. Class B, Grade 5, £1,740 per annum, rising by two increments of £75 and one of £50 to £1,940 per annum.

The person appointed will be directly responsible to the Sub-Area Manager for the administration and control of the Accountancy Department covering the staff dealing with accounts, costs and stores accounting, cash collection and banking. Candidates must have a recognised accountancy qualification.

Applications giving details of age, qualifications, experience, present position and salary should be addressed to the Chief Accountant, The East Midlands Electricity Board, Mapperley Hall, Nottingham, in an envelope marked "Confidential" and endorsed "Sub-Area Accountant" to reach him within 14 days of the date of this advertisement.

Derby and Burton Sub-Area

DEMONSTRATOR, BURTON DISTRICT
Vacancy No. 97/60.

Salary: N.J.C. Grade 1, £600 x £25—£700 per annum.

Possession of a recognised Diploma in Domestic Science or its equivalent is essential, and the possession of the E.A.W. Certificate for Demonstrators would be a further advantage.

Candidates for the appointment must be capable of conducting demonstrations of all types of domestic appliances and be experienced in general Service Centre duties.

Applications giving details of age, present position and salary, qualifications and experience should be addressed to the Manager, Derby and Burton Sub-Area, Electricity Offices, Iron Gate, Derby, in a confidential envelope marked "Demonstrator," to reach him within 14 days of the date of this advertisement.

Nottingham Sub-Area

THIRD ASSISTANT ENGINEER
(PLANNING AND DEVELOPMENT)
Vacancy No. 98/60.

Salary: N.J.B. Class K, Grade 9, £1,190/£1,325 per annum.

The duties will include assisting with system planning and design up to and including 33 kV, the preparation of schemes, design of substation layouts and overhead lines.

Applications giving details of age, present position and salary, qualifications and experience should be addressed to the Manager, Nottingham Sub-Area, 35-39 Carrington St, Nottingham, within 14 days of the date of this advertisement. (R 796)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER
(BUILDING)

REQUIRED at No. 2 Sub-Area Headquarters, Sandiway Hse, Northwich, Cheshire. Salary within range £965/£1,090 per annum (N.J.B. L/13).

Duties will include supervision of new building work and building maintenance throughout the Sub-Area. Previous experience as a Clerk of Works would be an advantage. Technical qualifications desirable.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager at the above address. Closing date: 5 Sept., 1960. (R 798)

ELECTRICAL ENGINEERS

required with experience in the installation of L.T. and E.H.T. cables, switchgear, transformers, etc. Good conditions and prospects. Superannuation Scheme. Reply stating age, experience, qualifications and salary required to Box No. 7967, Electrical Times. (R 761)

ALLEN WEST

ALLEN WEST AND CO. LTD.
BRIGHTON

invite applications for the following staff vacancies:

HEAD OFFICE SALES DEPARTMENT

Contracts Engineers for interesting and progressive work in the Contracts Section of Head Office Sales Department.

Candidates should be aged between 21 and 30 years, have received a good general education, be qualified to at least Ordinary National Certificate standard, and have had previous experience of motor control gear and switchgear. Preference will be given to those having experience with Marine Control Gear.

Ability to deal with technical sales correspondence is essential, and also a pleasing personality, as the work involves direct contact with customers.

Ref. ET/SD.3.

ELECTRICAL RESEARCH AND DEVELOPMENT LABORATORY

Development Testing Engineers, to work on experimental and prototype designs of control gear and switchgear.

Candidates must be qualified to at least Ordinary National Certificate standard, and possess ability to devise and make reliable electrical and physical measurements for performance assessment purposes.

The work entails close co-operation with the Company's Design Draughtsmen to assist in producing a sound well-engineered product.

Ref. ET/EL.1.

The Company operates a five-day week, generous Bonus and Superannuation Schemes, and provides good staff Canteen facilities.

All applications in writing, giving full details of age, education, qualifications, previous experience, and quoting the appropriate Reference No., should be addressed to:

The Personnel Manager
ALLEN WEST & CO. LTD.
Brighton 7

(R 773)

IMPERIAL SMELTING CORPORATION LIMITED

ASSISTANT ELECTRICAL ENGINEER—SWANSEA

Applications are invited from suitably qualified engineers aged 23-35 for the position of Assistant Electrical Engineer at the above Corporation's Swansea Works. The duties will involve assistance in the supervision and carrying out of electrical maintenance and repair work, installation of new equipment and advising on suitability of electrical equipment.

Candidates who are Graduate Members of the Institution of Electrical Engineers with three years' electrical supervisory experience will be considered, but a B.Sc. with five years' experience or Associate membership of the Institution of Electrical Engineers is desirable.

Applications should be marked "Confidential" and submitted, with appropriate references, to:—

ET/AEE
Personnel Manager
IMPERIAL SMELTING CORPORATION LTD.
St. Andrew's Road, AVONMOUTH (R 770)

ADDITIONAL STAFF. — JUNIOR ENGINEER having distribution experience (preferably with Supply Authority), excavations, cable laying, jointing, switchgear, substations and overhead line construction. FOREMEN capable of dealing with the above.—Written applications to: C. Maurice Contractors Ltd., Lindsey Rd, Bishop's Stortford, Herts. (R 695)

BRITISH ENGINE BOILER AND ELECTRICAL INSURANCE CO. LTD., Longridge Hse, Manchester 4. Electrical Surveyor required in Scotland. Permanent position carrying progressive salary scale £800/£1,100 and non-contributory pension. Candidates aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E. and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. (R 804)

DRAUGHTSMAN required for the Electrical Division of a large Building Contractor. For interesting work producing drawings for electrical installations in Schools, Factories and Office Blocks. Age 18-22. Good salary, Pension Scheme. State age and training, etc., to Box No. 7973, Electrical Times. (R 809)

ELECTRICAL ENGINEER required for Glasgow office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications, stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (R 805)

DESIGN ENGINEER for senior position with Electrical Engineers in Westminster. Applicants must have experience of Commercial and Industrial Installations and Instrumentation Systems and be capable of designing to customer's requirements, including preparation of Specifications. Applications stating age, educational background, qualifications, experience and salary required to Box No. 7963, Electrical Times. (R 715)

SPECIAL ANNOUNCEMENT

SEE PAGE 49

Vacancies for:

Electrical Engineer or Physicist
Physicist
Classical Physicist
Electronic Engineer
Statistician and Numerical Analyst
Physicist or Electrical Engineer
(R 793)

ELECTRICAL DRAUGHTSMAN able to apply himself to a wide variety of work. A knowledge of power switchboard construction would be an advantage.—Astral Switchgear Ltd., Alma Rd, Ponders End, Middlesex. (R 807)

BRITISH RAILWAYS

ELECTRICAL FITTERS REQUIRED

For maintenance of electrical equipment on the Distribution Section of the Eastern Region Electric Traction system in the London Area. Applicants must have served a recognised apprenticeship. Experience with H.V. Switchgear and/or control system an advantage. Shift working is involved. Rate of pay is the equivalent of £11 0s 9d per standard week of 44 hours, plus appropriate shift allowance which averages 33s per week, and enhanced pay for overtime and Sunday duty. Applicants will be required to undergo medical examination. Certain free and reduced-rate rail travel facilities. Pension and Sick Pay Scheme. Prospects of promotion. Apply in writing giving details of age, experience, etc., to the Electric Traction Engineer, (London Area), British Railways, Eastern Region, off Ley St, Ilford, Essex. (R 781)

BORD NA MONA

Vacancy For

ELECTRICAL ENGINEER

A vacancy exists for an Electrical Engineer with experience in design, construction and maintenance of overhead distribution networks. Candidates should possess a University Degree or equivalent qualification. Preference will be given to candidates who are not more than 35 years of age.

Entry point to the salary scale of £915/£35/£1,372, will depend on qualifications and previous experience.

Applications, stating age, qualifications and experience, should reach the Secretary, Bord na Mona, 28 Upper Pembroke St, Dublin, not later than Saturday, 10 Sept., 1960. (R 759)

EXCELLENT opportunity for TRANSFORMER DESIGNER in Bombay. Preferably single man aged between 35/45 years, having degree in Electrical Engineering from recognised University or equivalent diploma. Good physique, strong personality, able to deal with and influence Government Officials and Engineers at top level. At least 5—8 years' experience with leading Electrical Manufacturer in design and production dealing with Power Transformers up to 10,000 kVA at 136 kV. Able to design independently and improve existing designs in line with best modern practice. Production organising ability. Good salary and prospects with Service Agreement to suitable applicant. Write Box No. 7953, Electrical Times. (R 669)

THE ELECTRICITY COUNCIL

invite applications for the post of

SECOND ASSISTANT ENGINEER (SAFETY)

in the Safety Section of the Industrial Relations Department at Winsley St, W.1.

Applicants should have had good engineering training and experience. Membership of one or more of the professional engineering institutions would be an advantage. Some knowledge of accident prevention methods and of the Factories Acts and relevant Safety Regulations is desirable but not essential to an otherwise suitable candidate.

The successful candidate will be required to assist the Chief Safety Officer in technical work at Headquarters and the Council's Regional Safety Officers in the provinces when necessary.

The salary will be within N.J.B. Schedule C, Scale 15, i.e., £1,450/£1,890 p.a., inclusive of London Allowance (£1,510/£1,890 p.a. from 1 July, 1961), according to qualifications and experience.

Applications stating age, present position, salary and giving details of qualifications and experience should be forwarded to E. Landucci, The Electricity Council, Winsley St, W.1, by 9 Sept., 1960. Quote Ref. ET/84.

(R 802)

WORKS ELECTRICAL ENGINEER

We are looking for a Works Electrical Engineer to be responsible for the control of the Electrical Department at our Bromford Works in Birmingham.

This is a senior appointment with an attractive starting salary, and is offered to men with experience in the manufacture, installation and maintenance of heavy electrical machines, and in the control of labour. Men who have qualifications not less than H.N.C. will be preferred. The right man will probably be aged around 30.

Please write—giving experience, qualifications and age—to:

The Manager/Personnel,
Stewarts and Lloyds Ltd.,
Corby,
Northants.

S&L

(R 777)

TECHNICAL REPRESENTATIVE

This is a senior position requiring an electrical engineering background. A knowledge of the cable industry is desirable. Good salary and conditions. Write in confidence to Box No. 7969, Electrical Times. (R 762)

JUNIOR SALES ENGINEER, aged 20-30 years, required by progressive company in the field of electrical engineering. Qualification preferably to H.N.C. level. Suitable applicants will be given works training with view to eventual outside representation. Apply Managing Director, Gresham Lion Group Ltd., Gresham Hs, Twickenham Rd, Hanworth, Middx. (R 756)

ELECTRICAL CONTRACTS SUPERVISOR required for the Electrical Division of a large Building Contractor. Experienced in installations of Schools, Factories, Office Blocks. Capable of handling labour. Aged 35-45. Good salary, Pension Scheme, other attractive conditions. State age, training and experience to Box No. 7971, Electrical Times. (R 808)

JUNIOR DRAUGHTSMAN required by Hackbridge and Hewittic Electric Co. Ltd., Walton-on-Thames, for their switchgear drawing office. D.O. Works training essential with technical training to at least O.N.C.

Reply, stating age and experience, to "The Chief Mechanical Engineer." (R 775)

WANDLESIDE CABLE WORKS LTD. require CHIEF ELECTRICAL ENGINEER for their group of Cable Companies responsible for General Electrical and Technical specifications to their Cable Group Managing Director. Applicants should state age and experience and be familiar with the industry. This is an excellent opportunity for the right man with a really progressive Company. Mark your application "Personal" for the attention of the Managing Director, Wandleside Cable Works Ltd., 106 Garratt La, Wandsworth, S.W.18. All applications treated in strictest confidence. (R 615)

CHARTERED ENGINEERS
CONSULTING ENGINEERS

offer

OPPORTUNITY FOR INTERESTING VARIED & RESPONSIBLE WORK

to

Chartered Mechanical or Electrical Engineers with sound experience of Electrical Power Generation, primarily in its Mechanical Engineering aspects.

BONUS and PENSION SCHEMES.

SALARY according to qualifications and experience.

Applications giving full details of age, qualifications and experience within 14 days to Preece, Cardew and Rider, 8, 10 and 12, Queen Anne's Gate, Westminster, London S.W.1. (R 767)

ELECTRICAL ENGINEER

Required by Richard Costain Ltd. for work in Nigeria. Applications are invited from men, aged 30-45, with considerable experience of contractors' plant in the civil engineering industry. The successful candidate will be responsible to the Resident Plant Manager for the electrical maintenance of all plant on a very large contract.

Salary £2,000 per annum with bachelor accommodation provided free. Kit allowance £60. Tours of 18 months each followed by three months' paid leave in the U.K.

Please write stating age, qualifications and experience to:

Overseas Personnel Officer,
111 Westminster Bridge Rd,
London S.E.1.

(R 803)

BICC

BRITISH INSULATED CALLENDER'S CONSTRUCTION CO. LTD.

have vacancies in their Overhead Line Contracts Department in London for:

ASSISTANT DESIGN ENGINEERS

Work involves structural design aspects of Electrical Transmission and Distribution Lines. Previous experience desirable although not essential but structural background up to H.N.C. standard an advantage. After appropriate training successful applicants will be expected to conduct technical correspondence and negotiations. These posts carry progressive responsibility.

DRAUGHTSMEN

The work involves the preparation of arrangement and detail drawings for Electrical Transmission and Distribution Lines. The posts offer advancement to the status of Designer Draughtsmen.

Write, stating all details, including age and salary required to:

Staff Officer
B.I.C. CONSTRUCTION CO. LTD.
30 Leicester Square
London W.C.2

(R 769)

ELECTRICAL ENGINEER
QUAKER OATS LIMITED

A senior vacancy has arisen for a qualified (A.M.I.E.E. preferred) and experienced Electrical Engineer.

To be responsible for the planning, installation and maintenance of all electrical plant and equipment in a modern food factory and specification of electronic equipment, as used in automatic control systems.

The successful applicant will have had good industrial experience in both the above fields including direct control of craftsmen, preferably in the food processing industry. He will be responsible to the Chief Engineer and the position offers very considerable scope for the investigation and application of modern techniques.

Please write stating age and full details of education and career to:—

Personnel Manager (EE14)
QUAKER OATS LTD.
Bridge Road
Southall
Middlesex

(R 757)

CENTRAL ELECTRICITY GENERATING BOARD

requires

SHIFT CHARGE ENGINEERS

AT PADIHAM POWER STATION
nr. BURNLEY, LANCS.

The plant to be installed will consist of two B.T.H. turbines of 120 MW operating at a steam pressure of 1,500 lb per sq in. at an initial temperature of 1,010 degrees F., reheat temperature 1,005 degrees F. Two boilers of 860 klb/hr capacity, pulverised fuel fired with slag tap furnaces.

Applicants should have H.N.C. in Mechanical and/or Electrical Engineering. This is an opportunity for engineers possessing drive, vision and initiative.

Salary within the range of £1,440/£1,610 (K.6) and the post is superannuable. Standard application forms are not required, but applicants should set out their application in their own preferred form of presentation and quoting the names of two referees and forward to the Director of Labour and Welfare, Central Electricity Hse, 825 Wilmslow Rd, Manchester 20, by 6 Sept., 1960. Please quote vacancy No. E.161/397/C. Previous applicants need not re-apply. (R 768)

PIRELLI-GENERAL Cable Works Ltd.

have vacancies for the following grades of staff.

ASSISTANT ENGINEERS

Assistant Engineers for supervision of cable contracts including oil-filled cable to the highest voltages. Applicants should have qualifications not less than O.N.C.

SITE CLERKS

For work in connection with invoicing, records and P.A.Y.E.

DRAUGHTSMEN

Draughtsmen qualified to carry out steelwork design for power station and industrial cable installations, also route record draughtsmen.

FOREMEN

Foremen with experience of power station and industrial installations, also of trenchwork and mains cable laying.

Willingness to travel abroad will also be desirable.

An outside allowance will be paid when working on contract sites.

Application should be made to the
MANAGER,
INSTALLATION DIVISION,
PIRELLI-GENERAL CABLE WORKS LTD.,
EASTLEIGH, HANTS.

(R 778)

PUBLICITY ASSISTANT

Required by

BRUCE PEEBLES & CO., LTD.

EAST PILTON, EDINBURGH, 5

Applicants should have experience in technical journalism and ability to write lucid descriptions of engineering products and processes for publicity, press and other purposes, and be conversant with advertisement layout. The successful applicant would be required to write for and edit a Works' magazine.

The Company manufacture heavy electrical plant and industrial electronic equipment, and experience in those fields would be an advantage.

Full details, in confidence, of age, education, training, experience and salary required to Mr J. S. Baillie, Publicity Manager at above address.

(R 689)

WEST AFRICA, GHANA—ELECTRICAL PRODUCTS SALESMAN. Excellent opportunity exists for men 25-30 with sales/technical experience radios, TV, tape recorders, appliances, etc. State age, experience. If married state family. Progressive post with large merchant firm, long established in West Africa. Free quarters. Paid leaves, pension scheme.—Box No. 7969, Electrical Times. (R 806)

ELECTRICAL DRAUGHTSMAN

required in Consulting Engineers' office in London, O.N.C. standard, for electrical installations in schools, colleges, hospitals, etc. 5-day week, superannuation. Salary according to qualifications. Reply in writing to:

R. W. Gregory and Partners,
21 Bloomsbury Way,
W.C.1.

(R 758)

ELECTRICAL ENGINEERS

required with experience in the survey and erection of Overhead Lines. Good prospects and conditions. Superannuation Scheme. Reply stating age, experience, qualifications and salary required to Box No. 7965, Electrical Times.

(R 760)

The opportunity exists of a progressive appointment for a young ENGINEER for the development of SUPERTENSION CABLE ACCESSORIES.

Minimum qualifications, Ordinary National Certificate or equivalent.

Staff Pension Scheme.

Apply to the Secretary,
W. T. Glover and Co. Ltd.,
Trafford Park,
Manchester 17.

(R 782)

SENIOR ELECTRICAL DRAUGHTSMAN

required by

J. LYONS & CO., LTD.

(Ice Cream Division)

A vacancy exists for a Senior Electrical Draughtsman with experience on Motor Controls, Process and Sequence Controls associated with Automation, General Distribution and Lighting. An attractive salary will be paid to the right man and the appointment offers good prospects for further advancement. The Company offers good conditions of service and a contributory pension scheme. Drawing office situated in West London. Applications will be treated in the strictest confidence and should be made in writing to:

The Personnel Manager,
Lyons Maid House,
Hammersmith Grove,
London W.6.

(R 771)

AGENCIES

AGENTS REQUIRED England, Scotland and Wales, with established connection with ELECTRICAL WHOLESALERS for CABLE TRUNKING MANUFACTURERS. Write with full details of lines carried and territories covered to Sales Manager, Box No. 7961, Electrical Times. (R 714)

AGENTS required for Southern England and Wales, with live connections amongst Wholesalers, by old-established Company marketing first-class domestic electrical cooker components.—Box No. 7975 Electrical Times. (R 810)

EDUCATIONAL

GUARANTEED COACHING for CITY AND GUILDS EXAMINATIONS—Electrical Engineering Practice; Electrical Installation Work and Illumination Engineering. Also many practical non-examination courses. No books to buy. Write for FREE Prospectus, stating subject, to I.C.S., Intertext Hse, Parkgate Rd (Dept. 430), London S.W.11. (R 368)

E.A.W. CERTIFICATE FOR DEMONSTRATORS AND SALESWOMEN

The E.A.W. Examination in Electrical Housecraft (Theoretical) will be held on Thursday, 8 Dec., 1960, from 2 p.m. to 5 p.m. at various centres in Great Britain.

Full particulars and entrance forms may be obtained from:

Examinations Department,
The Electrical Association for Women,
25 Foubert's Place,
London, W.1

IMPORTANT.—The final date of entry for the Examination is 27 Oct., 1960. (R 772)

ERA

Leatherhead
Perivale
Bletchley
Reading

is increasing its staff at several levels

The conditions of work border on those of academic research providing full scope for originality and initiative. Good honours degree is essential for each of these posts; research or industrial experience will be an advantage but not essential.

Salaries on scales ranging up to £1,350 per annum.

Typical Vacancies

(*a*) **Electrical Engineer or Physicist:** For problems relating to power transformers, some already under way and others in the planning stage. All require considerable experimental and analytical ability.

(*b*) **Statistician and Numerical Analyst:** To undertake the processing and interpretation of increasing amounts of statistical data, programming for a digital computer, and to assist in the mathematics section generally.

(*c*) **Classical Physicist:** Basic work on the electrical heating of buildings including heat flow and heat loss. There is scope for participation in long range problems of energy conversion and thermal storage.

(*d*) **Electronic Engineer:** The post is in the switchgear research department (at Perivale) where there is continual need for the development of novel electronic and other instrumentation.

(*e*) **Physicist:** Research of a fundamental character on gas discharges, in the first instance on an investigation into plasma jets. The work of this section is already highly developed and expanding.

(*f*) **Physicist or Electrical Engineer:** Experience or knowledge of electronics. This post is at the Field Station of the Rural Electrification Section near Reading. It involves the design and testing of equipment including investigations on heat transfer problems in greenhouses.

Applications, giving details of age, qualifications and experience to

The Research Manager

ELECTRICAL RESEARCH ASSOCIATION

Cleeve Road, Leatherhead
SURREY

INDEX TO ADVERTISERS

Allen, John, & Sons (Oxford) Ltd. ... 6
Associated Electrical Industries Ltd. (Cable Division) 28, 29
Associated Electrical Industries Ltd. (Instrumentation Division) ... *Cover* (iii)
Associated Electrical Industries Ltd. (Heavy Plant Division) 51
Associated Electrical Industries Ltd. (Motor and Control Gear Division) 13
Associated Electrical Industries Ltd. (Transformer Division) 38
Astral Switchgear Ltd. 23
Automat Ltd. 30

Barries Electrical Agencies Ltd. ... 56
Babcock & Wilcox Ltd. 20
Backer Electric Co. Ltd. 25
Bayliss, Jones & Bayliss Ltd. 4
Bill Switchgear Ltd. 3
Birks, B., & Co. Ltd. 56
Bray, George, Ltd. 26, 27
British Insulated Callender's Cables Ltd. ... ... *Cover* (i)
British Klockner Switchgear Ltd. ... 6
British Railways—Eastern Region ... 22
Brown, N. C., Ltd. 12
Bruce Peebles & Co. Ltd. 19
Brush Electrical Engineering Co. Ltd. 16
Burn, George, Ltd. 8

Cable Strippers Ltd. 56
Carron Co. 31
Contactor Switchgear Ltd. 30
Crabtree, J. A., Co. Ltd. 37

D.J. Equipment (Hersham) Ltd. ... 58

East London Mica Works 58
Electric Construction Co. Ltd. *Cover* (ii)
Electrical Times Ltd. 52, 54, 60
Electrical Research Association ... 49
Elkay Electrical Mfg. Co. Ltd. 58
Ellison, George, Ltd. 34
English Electric Co. Ltd. 1

Ferranti Ltd. 21

General Electric Co. Ltd. ... 33, 53
Gent & Co. Ltd. 7
Greening, N., & Sons Ltd. 60
Grelco Ltd. 60

Hackbridge & Hewittic Electric Co. Ltd. 39

Ibbett Engineering Co. Ltd. 12
International Combustion Ltd. ... 36

Kautex Ltd. 54
Kitson's Insulations Ltd. 22

Mantle & Butterworth Ltd. 55
Martindale Electric Co. Ltd. 56
Midland Electric Manufacturing Co. Ltd. 11
M.K. Electric Ltd. 5

Otter Controls Ltd. 30

Pirelli General Cable Works Ltd. *Cover* (iv)

Ratcliffe, F. S. (Rochdale) Ltd. 12
Reyrolle, A., & Co. Ltd. 15

Sangamo Weston Ltd. 40
Scott, H. J., & Co. (Belfast) Ltd. ... 61
Spencer Wire Co. Ltd. 23
Statter, J. G., & Co. Ltd. 60
Sterling Varnish Co. Ltd. 24
Stream-line Filters Ltd. 32
Sutcliffe Speakman & Co. Ltd. 22

Taylor Tunnicliff & Co. Ltd. 59

Varilectric Ltd. 57
V.G. Porcelain Co. Ltd. 58
Volex Electrical Products Ltd. 9

Wade, G., & Son Ltd. 14
Wandleside Cable Works Ltd. ... 2
Washington Engineering Ltd. 10
Westinghouse Brake & Signal Co. Ltd. 62
Whiteley, B. S. & W., Ltd. 8
Wootton & Co. Ltd. 55

Zenith Electric Co. Ltd. 10

PATENTS

THE Proprietor of British Patent No. 709656 for "IMPROVEMENTS IN ELECTRODYNAMIC SOUND RECEIVING AND TRANSMITTING APPARATUS," desires to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London W.C.2. (R 785)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (R 1)

WANTED. — 350 h.p. SQUIRREL CAGE MOTOR, T.E.F.C. or D.P. H.Z.F.M. 3·3 kV 3 ph. 50 cycle supply. 585 r.p.m. preferred. Also D.O.L. Starter.—Telephone or write to Controls Section, Black-Clawson International Ltd., 18/19 Savile Row, London W.1. REGent 8341. (R 776)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service, fully guaranteed. Edgware 5566 (4 lines). — Service Electric Co. Ltd., Stanmore, Middx. (R 2)

METALWORK—All types of cabinets, chassis, racks, etc., to your own specification.—Philpotts Metalworks Ltd., Chapman St, Loughborough. (R 11)

FOR SALE

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. Edgware 5566/9. (R 4)

A.C. and D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½—100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton. Elmbridge 2234/5/6. (R 9)

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi 5105, 67 Rothschild Rd, W.4. (R 3)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512-3-4. Stores at Chobham, Surrey. (R 7)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (R 5)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (R 8)

PURLEY CHOKES AND BALLASTS. Our 80 W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (R 6)

SECOND-HAND Electrical Plant can be as good as new if you buy it from specialists. Write for our stock list. Dynamo and Motor Repairs Ltd., North End Rd, Wembley Pk, Middlesex. Telephone: Wembley 3121; Soho Rd, Handsworth, Birmingham. Telephone: Birmingham Northern 0898. (R 10)

"WESTINGHOUSE" STATIC PHASE CONVERTOR for sale. Input 400/440 or 200/250 volts, 50 cycles, single phase. Output, 400/440 volts, 4 kVA, 3 phase, with "Dublier" type APF4 capacitor, 15,000 volts peak surge.—F. J. Edwards Ltd., 359 Euston Rd, London N.W.1, or 41 Water St, Birmingham 3. (R 763)

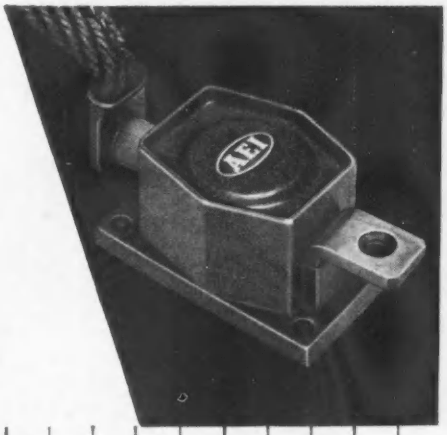
RECTIFIER FOR SALE

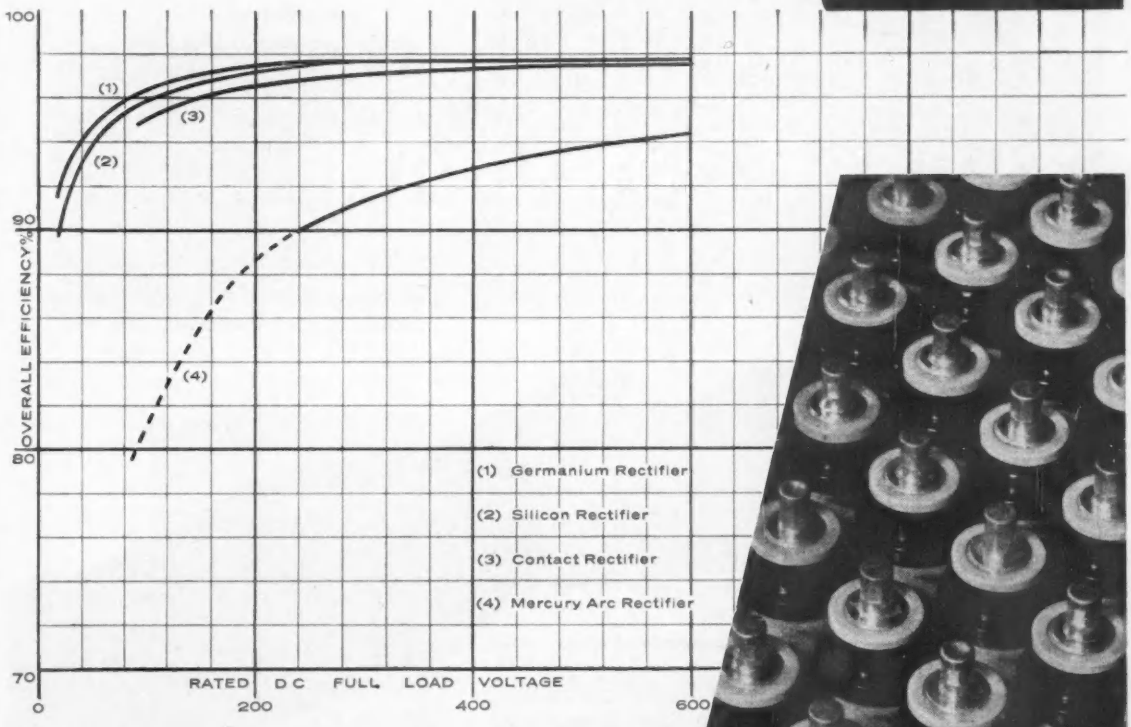
Multi Anode Mercury Arc
Nevlin Rectifier 70 kW
by
Lancashire Dynamo Motor Co. Ltd.
Input: 365-415 V 3-phase 50 cycle.
Output: 0/240/500 V D.C., 140 A.
Complete with switchgear and light load voltage suppression gear, etc.
This equipment is nearly new (late 1959)
Offers to:
Managing Director
The Western Daily Press
Bristol (R 698)

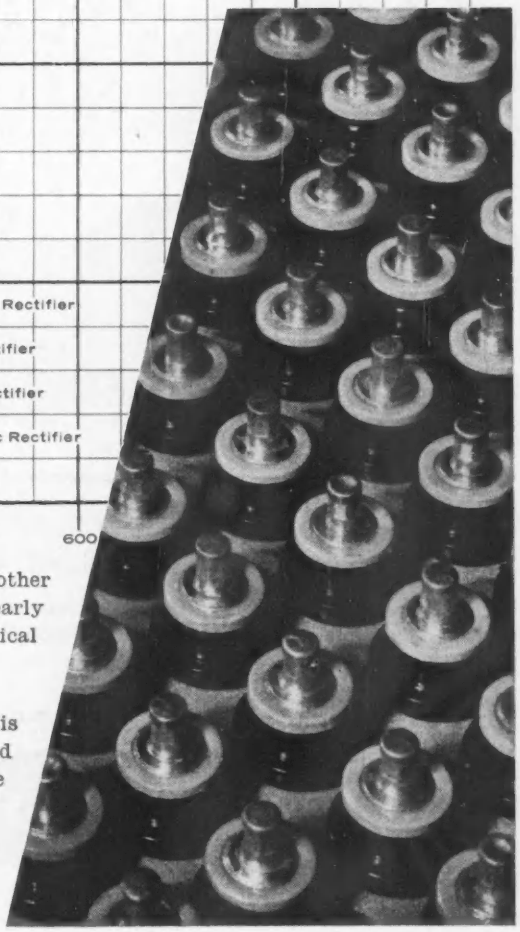
Another good reason for choosing

AEI

SEMICONDUCTOR POWER RECTIFIERS







Semiconductor rectifiers give a bonus in efficiency over other forms of power conversion equipment. The curves show clearly comparative efficiencies of germanium, silicon, mechanical contact, and mercury-arc rectifiers.

The high quality of AEI semiconductor power rectifiers is the result of original research, intensive development, and wide experience of application. Their efficiency in service is matched by outstanding dependability.

Write for further information and technical advice to Power Rectifier Sales, Rugby.

AEI

Associated Electrical Industries Limited
Heavy Plant Division
RUGBY ENGLAND

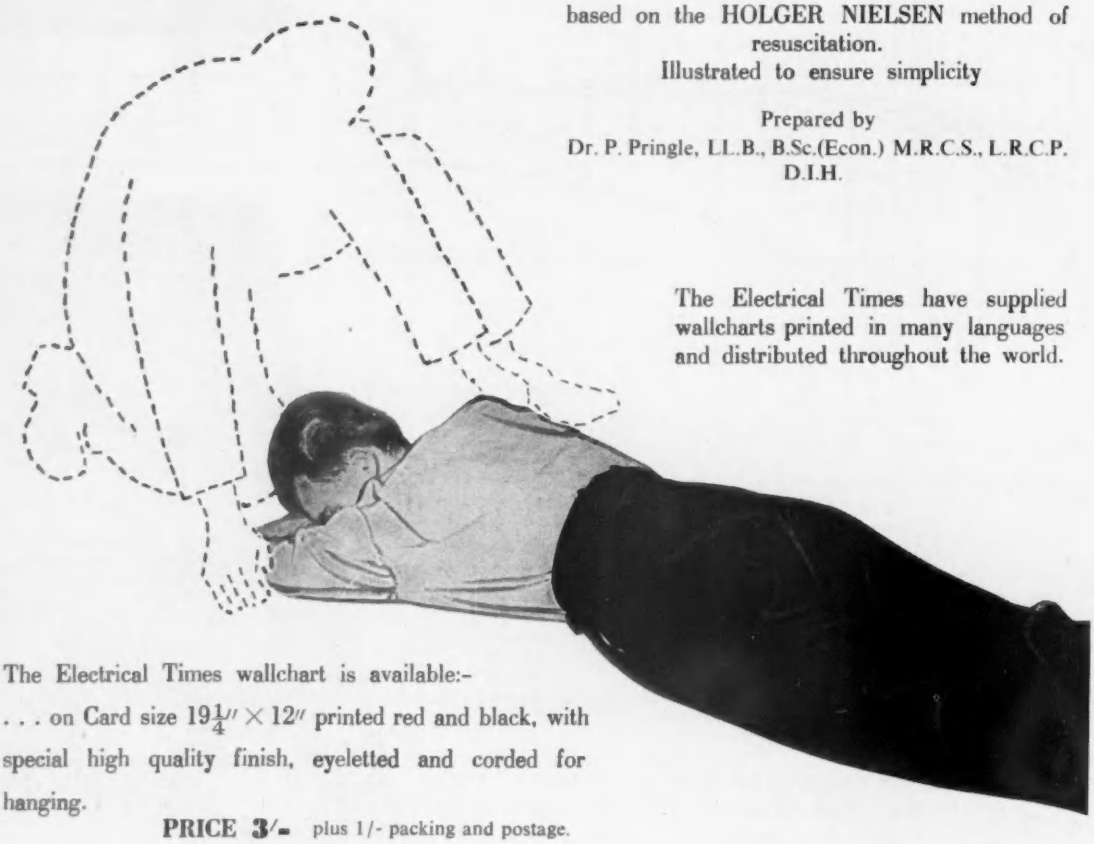
A557S

treatment for apparent death from ELECTRIC SHOCK

INSTRUCTION WALLCHART

based on the HOLGER NIELSEN method of resuscitation.
Illustrated to ensure simplicity

Prepared by
Dr. P. Pringle, LL.B., B.Sc.(Econ.) M.R.C.S., L.R.C.P. D.I.H.



The Electrical Times have supplied wallcharts printed in many languages and distributed throughout the world.

The Electrical Times wallchart is available:-

. . . on Card size 19¼″ × 12″ printed red and black, with special high quality finish, eyeletted and corded for hanging.

PRICE 3/- plus 1/- packing and postage.

. . . on Aluminium size 19¼″ × 12″ printed in red and black enamelled finish, eyeletted and corded for hanging.

PRICE 7/- plus 2/- packing and postage.

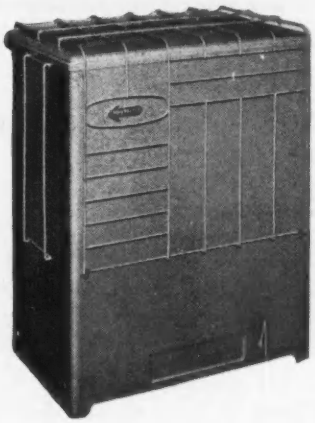
THE ELECTRICAL TIMES LTD

Publishing Department, Sardinia House, Sardinia Street, London, W.C.2

HOLborn 6016

Use Off-Peak Tariffs and cut the cost of Heating with

Nightstor Heaters



CUT FUEL COSTS. Nightstor Heaters store heat by night—taking advantage of the cheaper off-peak tariffs available from all Electricity Boards—and dissipate heat by day. Separate thermostatic control ensures that the heaters use only the minimum current necessary to provide a comfortable temperature throughout the following day from first thing in the morning. Thus Nightstor Heaters are not only efficient and clean, they represent maximum economy.

CUT CAPITAL COSTS. Simple and inexpensive to install, without alteration to structures or fittings. Nightstor Heaters are compact units which can be safely placed right up against the wall. Thus using the minimum of floor space.

CUT MAINTENANCE COSTS. Controlled automatically, Nightstor Heaters once installed need no maintenance or attention.

Nightstor is a G.E.C. product

(Not available for domestic use)

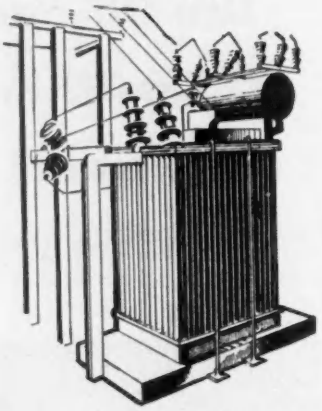
The G.E.C. specialises in industrial heating and manufactures every type of appliance.
Make use of our free advisory service without obligation.

THE GENERAL ELECTRIC CO LTD, MAGNET HOUSE, KINGSWAY, LONDON WC2

NEO K TEX

The Electrical Industry's Most Reliable Jointing Material

SYNTHETIC RUBBER BONDED CORK



for PERFECT SEALING

GASKETS · WASHERS · SHEETS
SYNTHETIC and RUBBER MOULDINGS and EXTRUSIONS

KAUTEX LTD ELSTREE WAY · ELSTREE · HERTS
Telephone, ELSTREE 1777/8/9 and 1770

TREATMENT FOR ELECTRIC SHOCK

عـــلاج

الصـــدمـــة الكهربائيـــة

ΠΡΩΤΑΙ ΒΟΗΘΕΙΑΙ ΕΙΣ
ΠΕΡΙΠΤΩΣΙΝ ΗΛΕΚΤΡΟΠΛΗΞΙΑΣ

ELEKTRİK ÇARPMASINA
karşı Tedavi

Menyelamatkan Orang2
YANG TERKENA CURRENT
LETRIK

觸
電
救
護
法

Mmoa a wɔde boa
NEA ELƐKTRIK AKYERE NO

Mboa a ɔwɔ dɛ Wɔdze Boa
NYIA ELƐTREK AKYER NO

بجلی سے زخمی ہونیوالے کیلئے
حفاظتی تدابیر

To meet the growing demand from overseas for the ELECTRICAL TIMES Wallchart "Treatment for Electric Shock" it has now been produced in Arabic, Greek, Turkish, Fanti, Twi, Cantonese, Malayan and Urdu.
Mounted on metal, size 17" × 11", varnished, corded and eyeletted.

Quotations for other languages on application

THE ELECTRICAL TIMES LTD.
Sardinia House · Sardinia Street · London · W.C.2

NEVER FORGET

WOOTTON

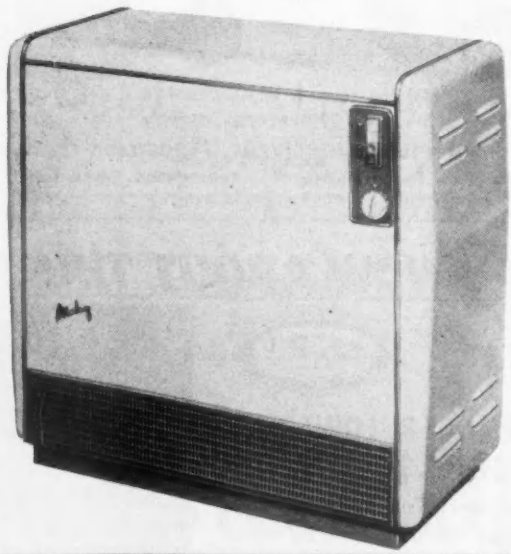
METER BOARDS ARE BEST!

Here's a trunk call coming through for all meter board users: "Wootton tested boards are extra tough, and combine strength plus reliability under all climatic conditions"—and don't forget WOOTTON wood blocks, sunk switch boxes and instrument cases.

WOOTTON & CO. LTD.,
ALMA WORKS, PONDERS END,
MIDDLESEX

Telephone: HOWard 1858

THE MARAG CONTROLLED STORAGE HEATER



- Double the output of conventional Storage Heaters during hours of occupation.
- Core thermostat limits charging to pre-set temperature.
- 25% of output by radiation.
- 75% of output emitted by the fan, controlled by room thermostat.
- Available in 3, 4½ and 6 kw models.
- Super quality vitreous-enamel finish in Bronze or Cream.

HIGH SAFETY FACTOR . . .

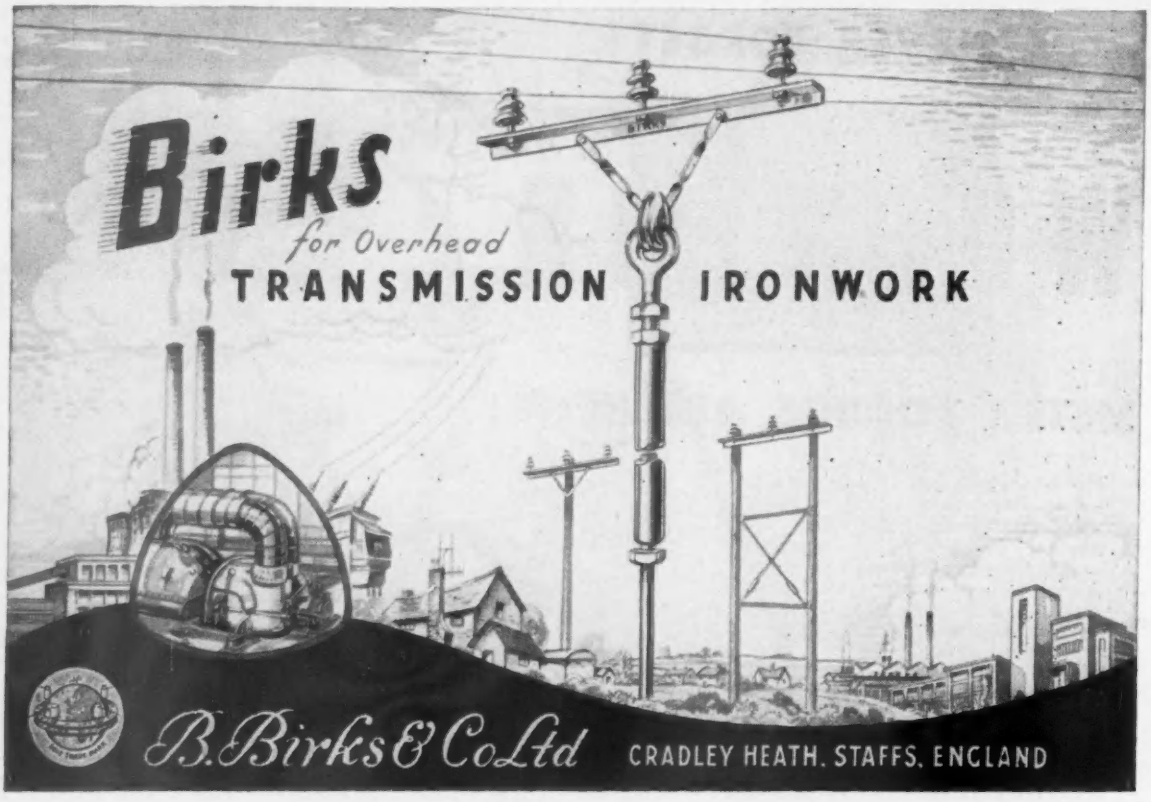
Outer casing temperature does not exceed 120° F.

Regd. Office:
MANTLE & BUTTERWORTH LTD.
Burnley Rd., Rawtenstall, Lancs.
Tel: Rossendale 2690/1

London Office:
Tel: Spr 1651
Syd 6820

Scottish Office:
WOOD'S AGENCIES
375-7 St. Vincent Street,
Glasgow, C.3
Tel: Central 4625/6

H



For Commutator and Slip Ring Grinding Equipment Consult the experts . . .

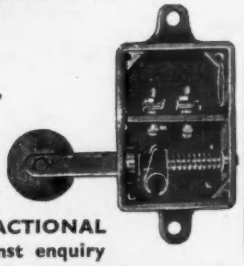
MARTINDALE

ELECTRIC COMPANY LIMITED

45 WESTMORLAND ROAD, LONDON, N.W.9

BARLECTA

STOP/START SWITCHES, FIRE ALARMS, LIMIT SWITCHES, ETC.



ASK FOR LIST No. 1458/ET.

We can quote FRACTIONAL H.P. MOTORS against enquiry

Barries Electrical Agencies Ltd.

Kemp Town, Brighton 7 Telephone No. Brighton 66433

EVERY ARCHITECT SHOULD KNOW ABOUT THIS!

PERFORMANCE DATA

WATTS	FITTINGS DIAMETER	WEIGHT LBS.	MAX MOUNTING HEIGHT FEET
200	10"-14"	3	25' 0"
300	12"-16"	5	22' 6"
500	14"-18"	7	20' 0"

ALUMINIUM FITTINGS ⅓ WEIGHT OF STEEL

LAMP CHANGING EQUIPMENT

GRABS :- 15W - 1500W, H.P.M.A. - ALL TYPES, PANEL INDICATORS, ALSO CUP TYPE MA/V 250-400W FOR E.D. GLASS CYLINDERS.

ALLOY **TUBE STRUCTURES** HT 15

4 TUBE TELESCOPIC MODEL

INTERCHANGEABLE TUBE MODEL

FIBRE GLASS TUBE MODEL

NO-CLIMB

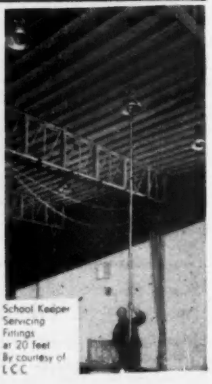
RAISING & LOWERING LIGHTING FITTINGS *by the* **NO-CLIMB SYSTEM** *as specified by leading Education Authority, Universities and Colleges.* Fittings designed by leading Manufacturers to Customers' requirements.

Consult us for further information. . .

CABLE STRIPPERS LTD LEIGHTON HOUSE · POTTERS BAR MIDDX Phone: Potters Bar 2267

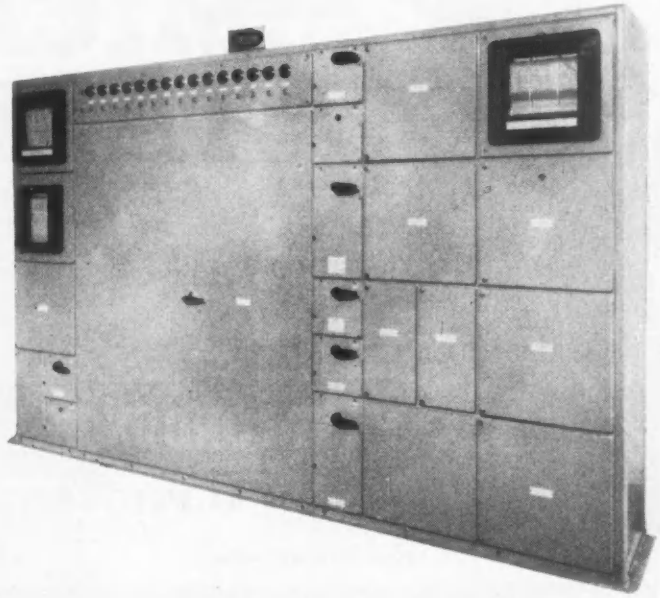
Export Enquiries to:

J. M. WOTHERSPOON & CO. LTD · 200 BISHOPSGATE · LONDON · E.C.2



School Keeper Servicing Fittings at 20 feet By courtesy of L.C.C.

CUBICLE SWITCHBOARDS



OUR CUBICLE AND PEDESTAL TYPE SWITCHBOARDS ARE FLEXIBLE IN DESIGN, NEAT, COMPACT, ARE FRONT ACCESS FOR WIRING AND SAVE MONEY

OUR FUSED SWITCHGEAR IS BEING INSTALLED IN S.S. CANBERRA

OUR RANGE INCLUDES:

- Distribution fuseboards without and with built-in isolators.
- Rising main busbars with associated floor distribution equipment including floor heating controls.
- Overhead busbars with plug-in fused tap offs.
- Sheet steel cable trunking.
- Underfloor and skirting ducting.

VARILECTRIC LIMITED

10 MELON ROAD, LONDON, S.E.15.
Telephone: Rodney 6895/6/7
Telegrams and Cables: Varitric London, S.E.15.

for

MICA TAPES

INSULATION

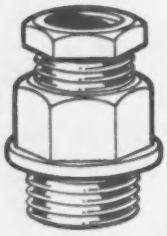
Consult

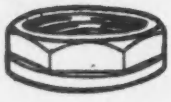
EAST LONDON MICA WORKS

RINGWOOD RD., WALTHAMSTOW, LONDON, E.17

ESTD. 1912

Phone: COPpermill 2248/9 *Telegrams:* Elmicmer, Easphone, London





NYLON
CABLE GLANDS
AND LOCK NUTS
IN BLACK & WHITE

Full details from:—

ELKAY ELECTRICAL MFG. CO. LTD.

42 WOBURN PLACE, LONDON, W.C.1. LANgham 1975

choose **PHOENIX**

the **QUICK-FIX**

PRESS-IN TERMINALS

WITH RANGE OF 20-300 AMPS ALL FITTING SAME MOUNTING RAIL

SEND FOR LEAFLET

NRP 3220

D. J. EQUIPMENT (HERSHAM) LIMITED

43 Queens Road, Hersham, Walton-on-Thames, Surrey Tel: 27672

QUICKEST, SAFEST, EASIEST TO USE FOR EVERY GAUGE WIRING

Registered **SCRUIT** *Trade Mark*

ONE PIECE PORCELAIN CONNECTORS BRITISH MADE

V.G. PORCELAIN CO. LTD GORST RD. PARK ROYAL, LONDON, N.W.10 *Telephone* ELGAR 7362

Distributors: S.O. Bowker Ltd., Gee (Birmingham) Ltd., Birmingham, and Medway Ltd., Brighton.

VAST

TECHNICAL EXPERIENCE

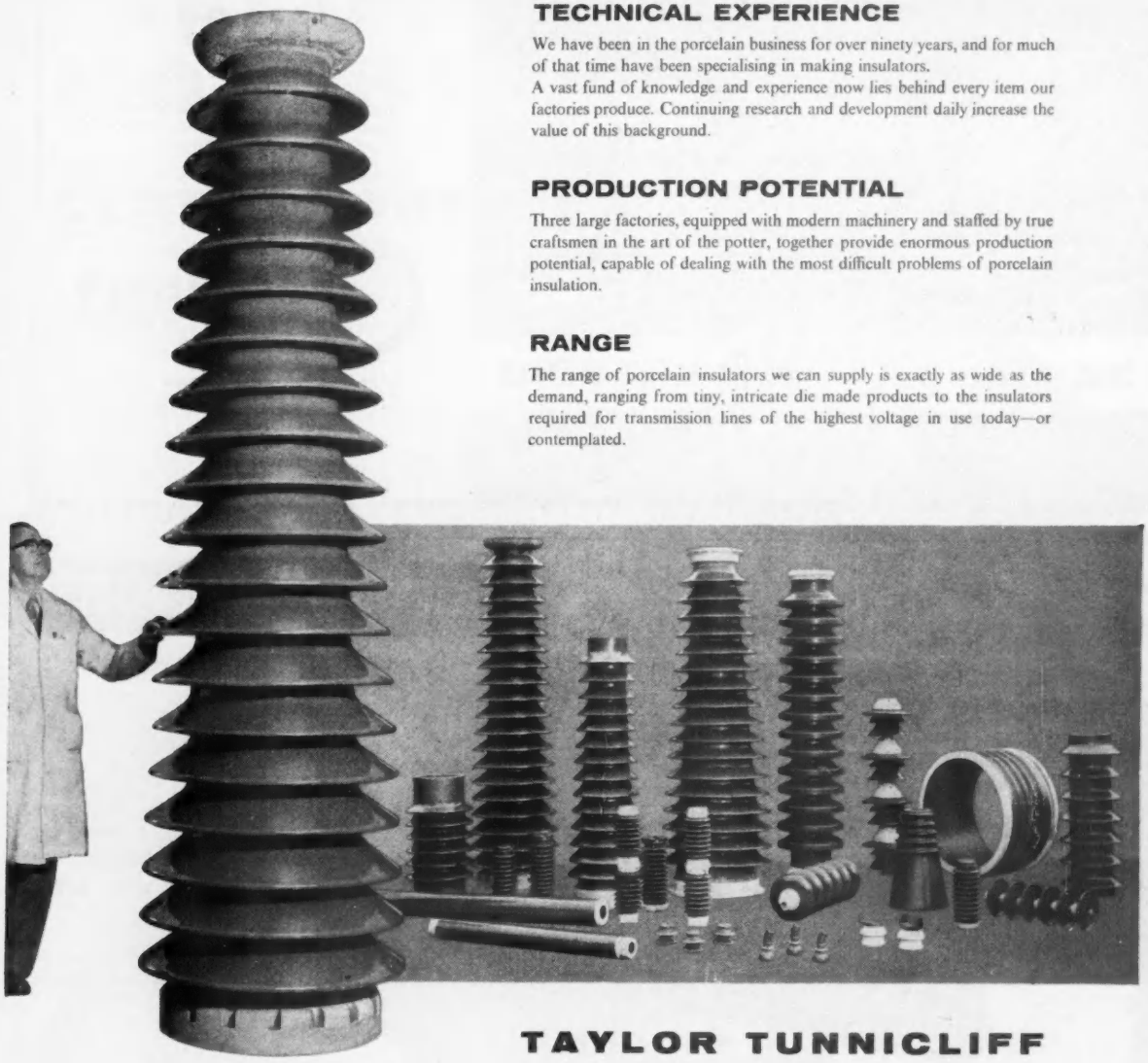
We have been in the porcelain business for over ninety years, and for much of that time have been specialising in making insulators.
A vast fund of knowledge and experience now lies behind every item our factories produce. Continuing research and development daily increase the value of this background.

PRODUCTION POTENTIAL

Three large factories, equipped with modern machinery and staffed by true craftsmen in the art of the potter, together provide enormous production potential, capable of dealing with the most difficult problems of porcelain insulation.

RANGE

The range of porcelain insulators we can supply is exactly as wide as the demand, ranging from tiny, intricate die made products to the insulators required for transmission lines of the highest voltage in use today—or contemplated.

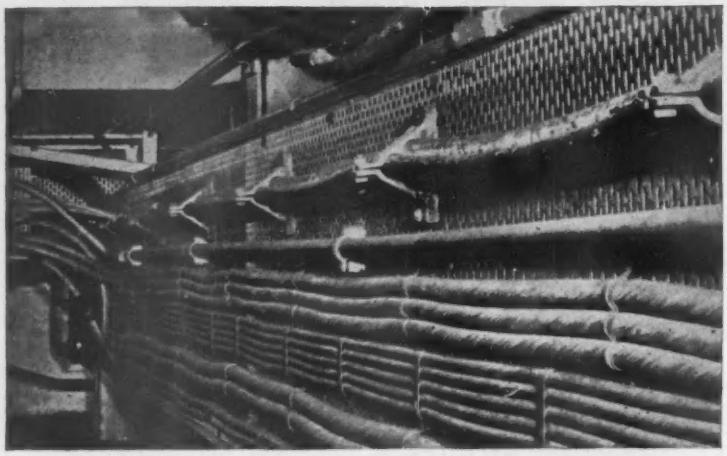


TAYLOR TUNNICLIFF
PORCELAIN INSULATORS

POSITIVE PROOF ALL OVER THE WORLD

TAYLOR TUNNICLIFF & CO., LTD
Head Office: EASTWOOD, HANLEY, STOKE-ON-TRENT. Tel: Stoke-on-Trent 25272/5
London Office: 125 HIGH HOLBORN, LONDON, W.C.1. Tel: HOLBORN 1951-2

PERFORATED CABLE PLATES . . . in STEEL OR ALUMINIUM ALLOY



Greenings Cable Plates are supplied in self-colour, painted or galvanised after manufacture. They are the most useful, permanent yet adaptable method of securing cables and conduits.

Greenings Cable Plates are reasonable in cost. Please write for details.

Established 1799

Greenings

N. GREENING AND SONS, LTD.
BRITANNIA WORKS
WARRINGTON · ENGLAND
P.O. BOX 22

Phone: Warrington 32401
Grams: Greenings Warrington
Telex No. 62195

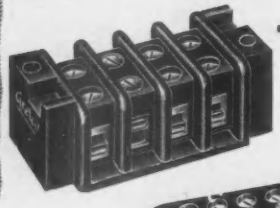
NG 75

FINE WOVEN WIRE * PERFORATED METALS

FOR DEPENDABILITY
fit and forget . . .

Grelco

Type AD4/H



TERMINAL BLOCKS

Type R

Many of our comprehensive range are Admiralty, Joint Service and G.P.O. approved. GRELCO blocks have a high safety factor and constantly specified where reliable performance under arduous conditions is required.

GRELCO LTD. MINEHEAD, SOMERSET
Telephone: MINEHEAD 740

SWITCHGEAR SPECIALISTS

STATTER

J. G. Statter & Co. Ltd., 82 Victoria St, S.W.1
A Member of the Metal Industries Group

Safeguards Against the Explosion Hazard In Industry

by F. H. Mann, M.I.E.E.

An indispensable book to Design and Works Engineers

Price 6/- *post free*

THE ELECTRICAL TIMES LTD.
Sardinia House Sardinia Street London, W.C.2

Scott

A.C. & D.C. MOTORS AND GENERATORS

WE MANUFACTURE

A.C. MOTORS ½ - 350 B.H.P.

D.C. MOTORS ½ - 200 B.H.P.

ALTERNATORS ½ - 125 K.V.A.

MOTOR GENERATOR SETS

GENERATORS ½ - 150 K.W.

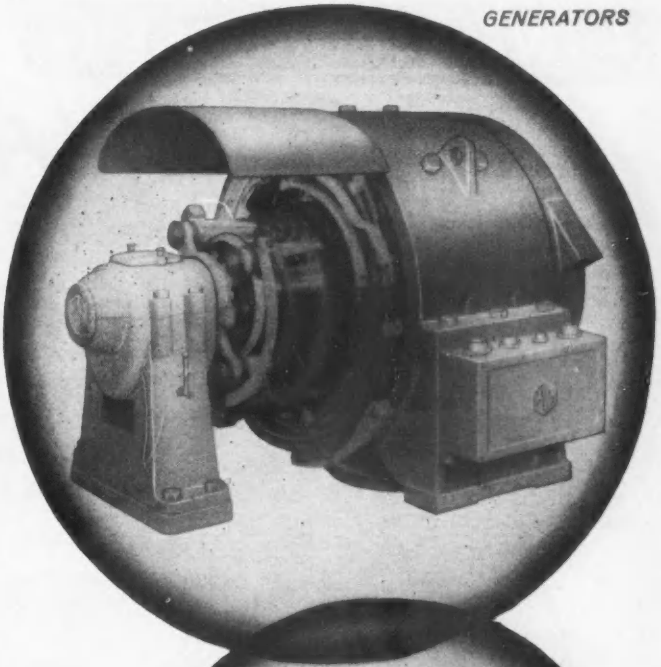
INVERTED ROTARY CONVERTERS

MARINE MOTORS

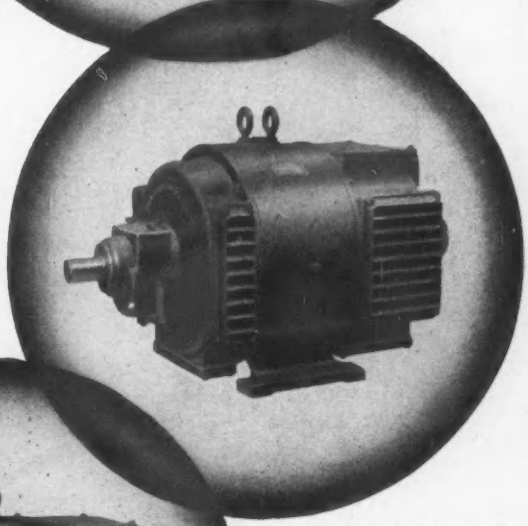
WARD LEONARD SETS

FAN MOTORS

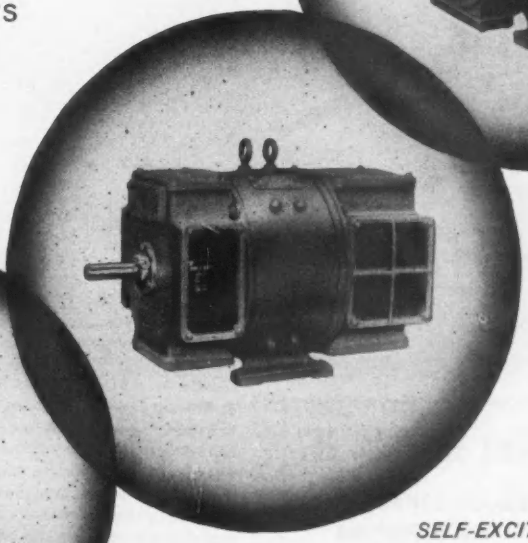
ETC.



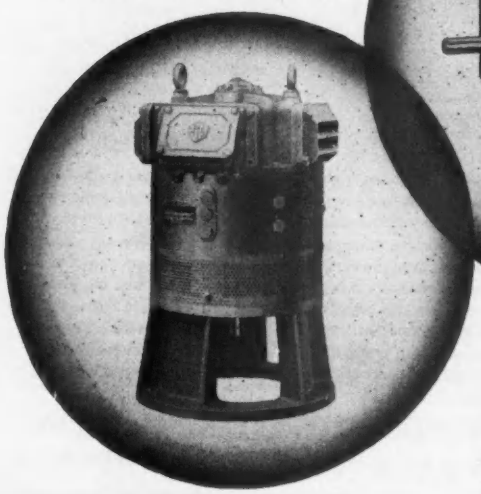
GENERATORS



D.P. OIL RING MOTORS



SELF-EXCITED ALTERNATORS



VERTICAL SKIRT MOTORS

HUGH J. SCOTT H.J.S.

VOLT WORKS, BELFAST, N. IRELAND

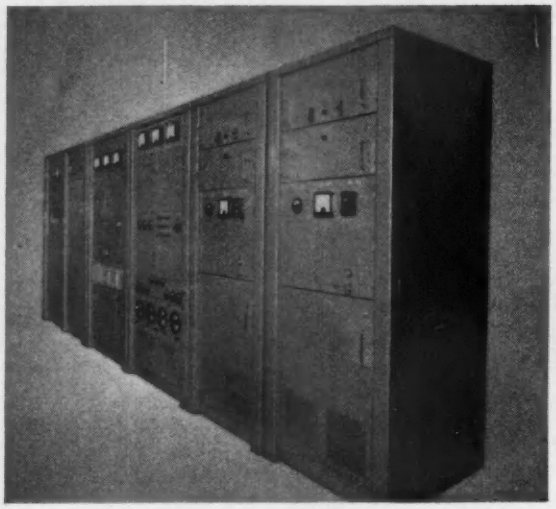
WESTINGHOUSE

WINGS DAY SEPT. 17th
GIVE FOR THOSE WHO GAVE

Rectifiers FOR ANGLO-SWEDISH SUBMERGED COAXIAL CABLE

GÖTEBORG

MIDDLESBROUGH



The repeaters in a submerged repeater cable are, from the point of view of their power supplies, all connected in series and inserted at intervals in the single core of the cable, which also carries all the speech channels. Power for the h.t. and heater supplies is fed into the cable in the form of a direct current which returns through the sea. The series connection of the repeaters means that high voltages at low current are required, and to ensure long life of the repeater it is also necessary to accurately regulate the current against mains variations, fault conditions and when switching on.

To meet the requirements of d.c. power supplies for submerged repeaters Westinghouse have developed a range of equipments which employ a transductor regulator, controlled by means of a magnetic discriminator. The complete equipment illustrated above, which is being supplied for the Anglo-Swedish cable system, consists of a suite of six cubicles comprising three constant current units, two control cubicles, power separation filter and cable terminating cubicle. Complete indication, alarm, interlock and test facilities are built into the equipment.

Other equipments are at present in the course of being supplied for the Transatlantic Cable and System, H.M.T.S. Monarch, and the Bermuda Manahawkin Link.

Visit Stand No. 257
S.B.A.C. Flying Display and Exhibition at Farnborough

For full details of Westinghouse rectifiers for telecommunications please write to Dept. E.T.17 Rectifier Division (Special Products)

WESTINGHOUSE BRAKE AND SIGNAL CO. LTD · 82 YORK WAY, KING'S CROSS · LONDON, N1.

Terminus 6432

Printed in England by Gibbs & Bamforth Ltd., St. Albans, for the Proprietors, THE ELECTRICAL TIMES LTD., and published at Sardinia House, Sardinia Street, London, W.C.2.

Accent on Accuracy

WITH THE TYPE NF SERIES

The type NF3 (two-element) and NF4 (three-element) watt-hour and maximum demand meters have been designed to meet present day requirements for overall accuracy. Their easily accessible adjustments, lightweight construction and handsome appearance, will commend themselves to all users. The meters comply in all respects with British Standard 37: Part 4: 1954 and Part 5: 1955.

Type NF3 two-element watt-hour meter

Type NF4 three-element maximum demand meter

For further information please write for 'The Art of Metering', which gives full details of these meters, to your local AEI office or direct to:

AEI

Associated Electrical Industries Limited

INSTRUMENTATION DIVISION - Instrument & Meter Department

Trafford Park, Manchester 17

G/A 801

HIGH TEMPERATURE SYNTHETIC ENAMELLED (POLYESTER RESIN BASE) WIRES AND STRIPS

A Pirelli-General product possessing all the excellent properties of Pigenam (P.V.A.) wires and strips plus exceptional thermal stability.

CABLE WORKS LTD
SOUTHAMPTON ENGLAND

Write for full details of this high quality Class B product.